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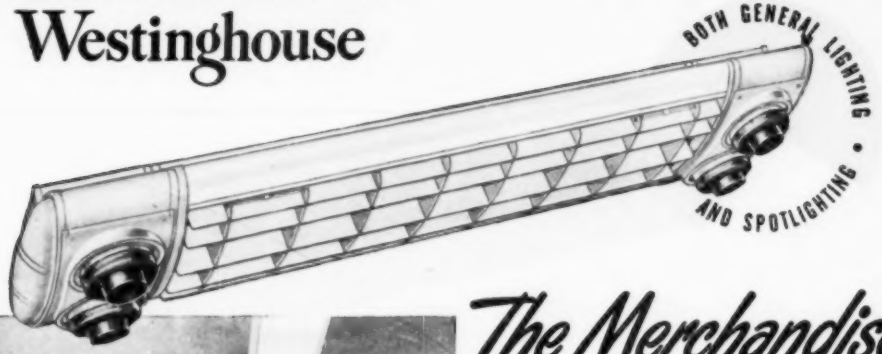

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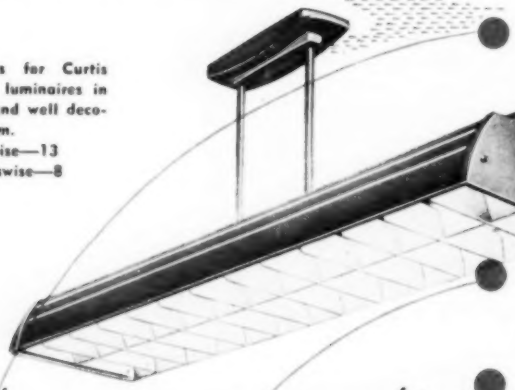

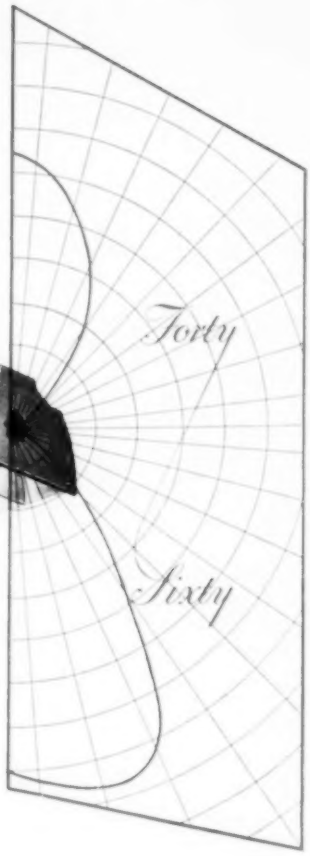

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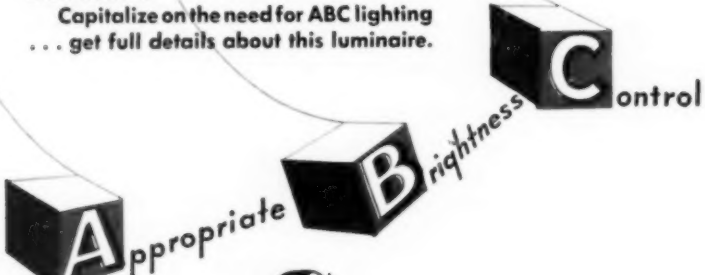

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The Effects of Luminous Ceiling Elements on Visibility

By BENJAMIN SCOTT BENSON, JR.
ERIC H. CHURCH

The purpose of this paper is to present the results found and conclusions reached from a study of louvered and paneled ceiling systems on the basis of visual tasks as found in a drafting room.

ONE YEAR ago, at the Technical Conference of the Illuminating Engineering Society in Boston, one of the authors presented a paper entitled "Louverall Lighting Techniques[1]" in which the problem of reflected glare under louvered ceiling systems was discussed. The purpose of this paper is to present the results of further studies of such systems with particular emphasis being placed on the aforementioned ramification. In addition to louvered systems, the study was broadened to include an examination of a translucent panel system and several combination systems which are discussed in detail later in this paper.

It was decided to use as the basis for this investigation a typical small office in which the main endeavor encompassed the task of drafting. The results of this study, while keyed to this exacting visual problem, can also be applied to other seeing tasks in business which have a similar degree of severity.

The room used for these tests was that used in previous studies.[1] The physical dimensions of the room together with its various reflection factors are shown in Fig. 1. In order to compare the several types of systems, the lighting equipments and lamps used were identical throughout each series of tests with only the ceiling element (*i.e.* louvers, panels, etc.) being changed.

The lighting equipments consisted of closed end porcelain enameled reflectors permitting the use of either 1, 2 or 3 fluorescent lamps each of the 40-watt, T-12, 4500° white type. For two series of tests lighting equipments of the same general type were substituted to enable the use of either one or two fluorescent lamps each of the 40-watt, T-17 (low brightness), 4500° white type.

The louvered systems investigated included only those using translucent materials since previous data have shown that, with comparable lighting equipments, opaque louvers were considerably lower in utilization efficiency.[1] The translucent material used for the louver vanes was found to have a reflection factor of 16 per cent and a transmission factor of 78 per cent.

Among the louver designs considered was the conventional type having 90° (or vertical) vanes forming a 2" x 2" x 2" cell and affording 45° lengthwise and crosswise shielding (Fig. 2A). Another type investigated was one having tilted vanes in one direction (Fig. 2B). A number of different angles of tilt were investigated from the standpoint of shielding and utilization efficiency. With the same degree of shielding (vertical) with respect to the observer, it was determined photometrically that the angle of vane tilt should be in the neighborhood of 45° from the standpoint of maximum utilization efficiency. As a result the tilted vane louvers used in the test had the crosswise (to the lamp) vanes at 45° with the lengthwise blades at 90°. This type of louver afforded a 90° (vertical) shielding in one direction parallel to the lamps (and to the observer's line of vision), a 26½° shielding in the opposite direction and 45° shielding crosswise to the lamps.

The luminous panels were formed by laying tracing paper over the vacated support frames for the

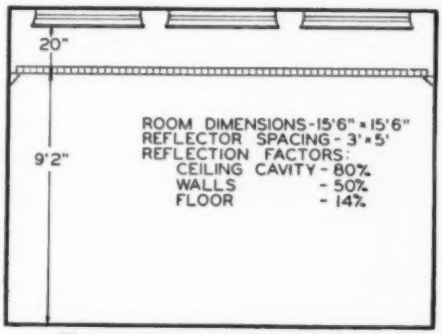
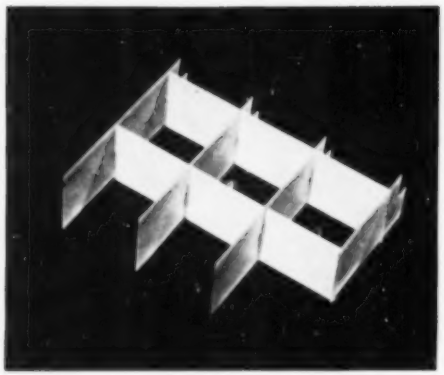


Figure 1. Cross-section of the test room.

A paper presented at the National Technical Conference of the Illuminating Engineering Society held September 20-23, 1949, French Lick, Indiana. Authors: Benjamin Electric Manufacturing Co., Des Plaines, Ill.



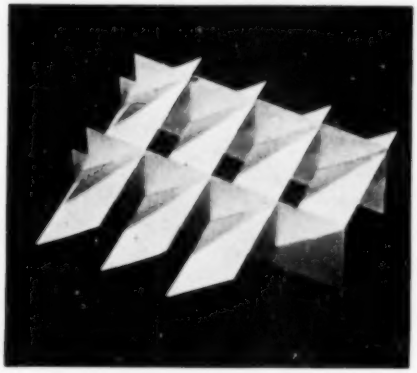


Figure 2 A. (Left) Portion of translucent louver — 90° vanes. Figure 2 B. (Right) Portion of translucent louver — 45° vanes in one direction.

louvers. The material used had what the authors considered to be a suitable translucency. The reflection factor was measured to be 25 per cent and the transmission factor 66 per cent.

The combination systems consisted of the 90° vane louver element throughout the room with various methods used to reduce the brightness of the lamps in only that portion of the system which might contribute to reflected glare in the area of regard. It was believed that a study of such combinations would be of value in that they would have the least effect on the utilization efficiency of the system as a whole.

Throughout the series of tests (including footcandle, visibility and brightness measurements) voltage and temperature were controlled. All lamps used were selected and aged for 100 hours. Data found in this paper are based on initial (clean) conditions at 100 hours of lamp life.

Included in the tests were the following systems:

A. 90° vane translucent louvers with T-12 (high brightness) lamps.

B. 45° vane translucent louvers with T-12 lamps.

C. Translucent panels with T-12 lamps.

D. 90° vane translucent louvers with T-12 lamps (center louver panel—in reflected glare area—45° vane louvers).

E. 90° vane translucent louvers with T-12 lamps (center louver panel—in reflected glare area—90° vanes plus translucent panel above).

F. 90° vane translucent louvers with T-12 lamps (center reflector—in reflected glare area—with opal diffusing cover).

G. 90° vane translucent louvers with T-12 lamps (all reflectors with opal diffusing covers).

H. 90° vane translucent louvers with T-17 (low brightness) lamps.

Comparison of Systems—Utilization Efficiencies

To provide a comparison of the relative utilization efficiencies of the various systems under consideration, footcandle readings were taken with a cosine corrected instrument at 36 stations throughout the room. Fig. 3 shows graphically the average horizontal footcandles at a height of 30 inches above the floor for the various ceiling elements and combinations thereof. Values are shown for the lighting equipments operating with three, two and one lamps per reflector with the exception of the low brightness equipments which had a maximum of two lamps per reflector, and combinations which were measured only with three lamps per reflector.

Table I is a compilation of the data shown in Fig. 3 expressed as relative utilization efficiencies in terms of that of the 90° translucent louvers with T-12 lamps equal to 100 per cent.

As shown in Table I, under the conditions of the test, the 90° vane translucent louver system with T-12 lamps was over 6 per cent more efficient (utili-

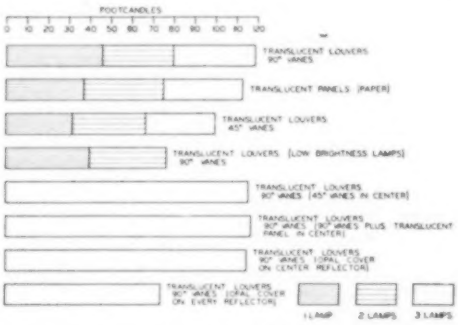

FOOTCANDLES
0 10 20 30 40 50 60 70 80 90 100 110 120
TRANSLUCENT LOUVERS 90° VANES
TRANSLUCENT PANELS (PAPER)
TRANSLUCENT LOUVERS 45° VANES
TRANSLUCENT LOUVERS (LOW BRIGHTNESS LAMPS) 90° VANES
TRANSLUCENT LOUVERS 90° VANES (45° VANES IN CENTER)
TRANSLUCENT LOUVERS 90° VANES (90° VANES PLUS TRANSLUCENT PANEL IN CENTER)
TRANSLUCENT LOUVERS 90° VANES (OPAL COVER ON CENTER REFLECTOR)
TRANSLUCENT LOUVERS 90° VANES (OPAL COVER ON EVERY REFLECTOR)
1 LAMP
2 LAMPS
3 LAMPS

Figure 3. Average horizontal footcandles on a plane 30 inches above the floor using various ceiling elements.

TABLE I.—Relative average utilization efficiencies of various ceiling elements.

Ceiling Element	Relative Average Utilization Efficiency
90° Vane Translucent Louvers (T-12 Lamp)	100%*
45° Vane Translucent Louvers (T-12 Lamp)	82.0%*
Translucent Panels (T-12 Lamp)	93.6%*
90° Vane Translucent Louvers—45° Vanes in Center (T-12 Lamp)	97.4%†
90° Vane Translucent Louvers—90° Vanes + Trans. Panel in Center (T-12 Lamp)	98.6%†
90° Vane Translucent Louvers—Opal Cover Center Reflector (T-12 Lamp)	97.0%†
90° Vane Translucent Louvers—Opal Covers all Reflectors (T-12 Lamp)	62.4%†
90° Vane Translucent Louvers (T-17 Low Brightness Lamp)	98.0%‡

* Average of 3, 2 and 1 Lamp
† 3 Lamp only
‡ Average of 2 and 1 Lamp

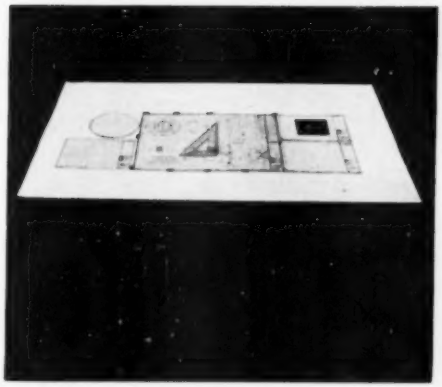


Figure 4. Top of drawing board showing targets used for tests.

zation-wise) than the translucent panel system. Previous data have shown that with a greater depth of cavity, all other conditions remaining equal, this difference is even greater. In one test, for instance, it was found that the 90° vane translucent louver system had a 12 per cent greater utilization efficiency than the translucent panel system.

The utilization efficiency of the 45° vane louver system is somewhat low due in part to so-called light trappage between the tilted vanes and in part to the asymmetric distribution of the system. The utilization would be improved in areas of higher room index and by the use of directional lighting equipments in the cavity. The utilization efficiency of the system using the 90° vane louver element in combination with opal diffusing covers on every reflector was expectedly low. The systems using various combinations of elements to reduce the brightness in the nadir to 45° zone in only the section which might possibly cause reflected glare, resulted in but little reduction in the utilization efficiency compared to that of the base system using the 90° vane louver element throughout.

Comparison of Systems—Visibility

The comparison of the various systems from the standpoint of visibility entailed the simulation of typical drafting conditions.

Near the center of the test room was placed a drawing board (Fig. 4) measuring 52" by 36" at a height of 31" and tilted at an angle of 10° from the horizontal. With the draftsman (observer) in position and with a mirror placed at his center of regard on the board, the exact position of the board was determined as that location where he had full view of the reflected lamp images of the center lighting equipment with no louvers or panels in place. This position caused the center of regard to fall within the zonule of reflected glare. To locate the center of regard in the zone of no reflected glare, the board and observer were so arranged that the mirror, when positioned at the center of regard, reflected that portion of the ceiling element located midway between adjacent lighting equipments.

It is recognized, that in a drafting room there are a great many types of visual tasks having varying degrees of severity. The visual task selected for these tests was believed to be representative of drafting room practice, and in addition, provided a degree of control which practically eliminated the possibility of guess-work on the observer's part. The task consisted of viewing a blackline print of a small interrupted circle (Fig. 5) through a sheet of tracing (pencil) cloth. The overall diameter of the circle was 0.206", the width of line 0.026" and the interruption 0.028". At a distance of 14" this interruption subtended a visual angle slightly less than 0°7'. Viewed through the tracing cloth, the reflection factor of the background was measured to be 67 per cent while that of the circle was determined to be 6 per cent.

Using the above described "target" at the center of regard, visibility measurements were made by the observer using a Luckiesh-Moss visibility meter held fixedly in a suitable support at a distance of 14 inches from the task and at normal viewing angle. The criterion of visibility was for the observer to determine not only the presence, but also the location of the interruption in the circle after it was rotated about its center to a radial position unknown to him. In order for the observer's reading to be accepted by the recorder, it was first necessary for the former to positively identify the position of the interruption in terms of the clock. Readings for each set of conditions were continued until

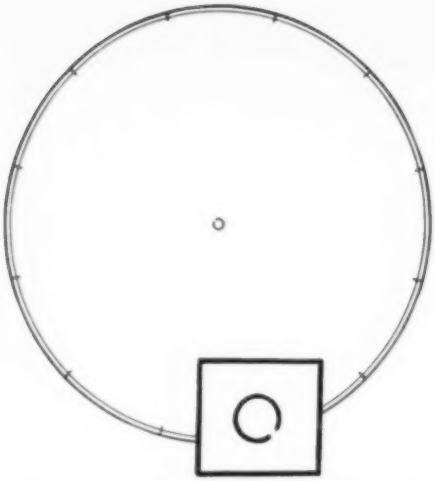


Figure 5. Close-up of target used with visibility meter. Insert shows enlarged view of interrupted circle at center of target.

a significant average was established.

A series of brightness measurements were taken at the center of regard with a Luckiesh-Taylor brightness meter on targets (Fig. 6) having comparable reflection factors to the target used with the visibility meter. These targets were obtained by developing unexposed and exposed (through tracing cloth) samples of black-line paper. The brightness readings were used as a check on the visibility measurements by determining the VF (visibility factor) according to Darley and Ickis.[2] Additional brightness readings of the targets covered by a typical yellowish celluloid draftsman's triangle (Fig. 7) were used to compute a "Triangle

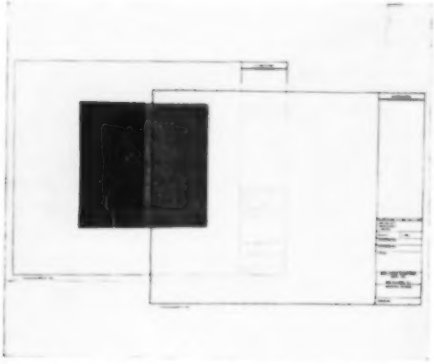


Figure 6. Close-up of target used with brightness meter.

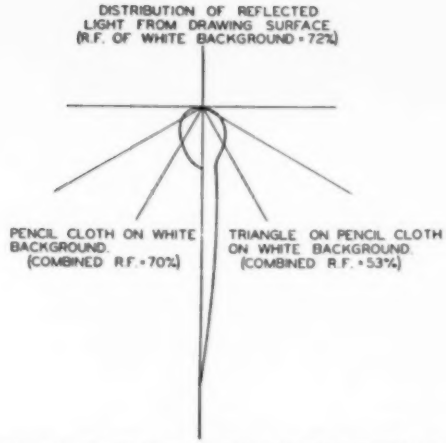

DISTRIBUTION OF REFLECTED LIGHT FROM DRAWING SURFACE (R.F. OF WHITE BACKGROUND = 72%)
PENCIL CLOTH ON WHITE BACKGROUND. (COMBINED R.F. = 70%)
TRIANGLE ON PENCIL CLOTH ON WHITE BACKGROUND. (COMBINED R.F. = 53%)

Figure 7. Distribution of reflected light (normal incidence) from drawing surface with and without triangle.

Visibility Ratio" later discussed in this paper.

Shown in Table II are the tabulations of the results obtained from the visibility and brightness measurements using the targets previously described. For each type of ceiling element (*i.e.* louvers, panels, etc.) are shown the footcandles on the target area of the drawing board with the draftsman in position and two sets of results based upon conditions conducive respectively to reflected glare and to no reflected glare.

Table II gives for each condition the PMV, or Percent Maximum Visibility determined from the visibility measurements, and the Triangle Visibility Ratio determined from the brightness measurements.

The term "Percent Maximal Visibility" has been described in previous publications[3,4] so this paper need not discuss it further than to say that it is a scale based on a Relative Visibility of 20 being considered a practical maximum and assigned the value of 100 per cent with 0 per cent assigned, as a minimum, to a Relative Visibility of 1.9.

The term "Triangle Visibility Ratio" has been used to express the measure of the reduction in visibility caused by specular reflections from the glossy surface of the celluloid triangle placed atop the basic visual task. It is recognized that this condition is not representative of normal visual tasks in drafting as the draftsman rarely views his work through such a medium. The term was considered to be of some limited value, however, in that it afforded an approximate method of comparison of the various lighting systems from the aspect of possible deleterious reflected brightness. The basis for the values given under the Triangle

TABLE II.—Tabulation of the Per Cent Maximal Visibilities and Triangle Visibility Ratios of the various ceiling elements.

Ceiling Element	Ft-c on Board (draftsman in position)	Zonule of Reflected Glare: Percent Maximal Visibility (PMV)	Zonule of Reflected Glare: PMV (in % of translucent panels = 100%)	Zonule of Reflected Glare: Triangle Visibility Ratio %	Zonule of Reflected Glare: Triangle Visibility Ratio (in % of translucent panels = 100%)	Zone of No Reflected Glare: Percent Maximal Visibility (PMV)	Zone of No Reflected Glare: PMV (in % of translucent panels = 100%)	Zone of No Reflected Glare: Triangle Visibility Ratio %	Zone of No Reflected Glare: Triangle Visibility Ratio (in % of translucent panels = 100%)
3 LAMPS PER REFLECTOR									
90° Vane Translucent Louvers	126.8	84.1	101.8	83.3	90.2	86.8	101.3	95.1	102.5
45° Vane Translucent Louvers	101.2	83.2	100.6	92.0	99.7	83.8	97.9	96.9	104.4
Translucent Panels	122.2	82.7	100.0	92.3	100.0	85.6	100.0	92.8	100.0
90° Vane Translucent Louvers—45° Vanes in Center	120.5	81.3	98.5	94.3	102.2				
90° Vane Translucent Louvers—90° Vanes + Trans. Panel in Center	125.0	83.7	101.2	91.7	99.3				
90° Vane Translucent Louvers—Opal Cover Center Reflector	122.8	81.0	98.0	92.2	99.9				
90° Vane Translucent Louvers—Opal Covers all Reflectors	81.0	76.6	92.6	90.1	97.6	76.9	89.9	97.8	105.4
Note: Unless otherwise indicated all lamps are 40 W, T-12, 4500° white.									
2 LAMPS PER REFLECTOR									
90° Vane Translucent Louvers	88.9	79.0	105.5	88.3	93.0	82.4	109.5	95.5	100.2
90° Vane Translucent Louvers—(LOW BRIGHTNESS LAMPS)	86.5	83.3	111.1	94.0	99.1	83.5	111.0	95.5	100.2
45° Vane Translucent Louvers	68.8	81.4	108.8	96.1	101.3	81.9	108.9	95.1	99.8
Translucent Panels	80.2	74.9	100.0	94.9	100.0	75.1	100.0	95.3	100.0
1 LAMP PER REFLECTOR									
90° Vane Translucent Louvers	44.2	72.5	111.1	89.7	98.7	78.1	117.0	97.0	103.6
90° Vane Translucent Louvers—(LOW BRIGHTNESS LAMPS)	44.2	73.5	112.7	91.4	100.6	74.9	112.0	94.1	100.5
45° Vane Translucent Louvers	33.5	69.5	106.5	91.4	100.6	70.1	105.0	93.4	99.8
Translucent Panels	39.5	65.2	100.0	90.9	100.0	66.8	100.0	93.6	100.0

Note: Unless otherwise indicated all lamps are 40 W, T-12, 4500° white.
Low brightness lamps are 40 W, T-17, 4500° white.

Visibility Ratio columns are the brightness measurements of the targets both with and without the triangle in place. From these measurements were computed Visibility Factors both with and without the triangle. The Triangle Visibility Ratio is equal to the ratio (in per cent) of the Visibility Factor as determined with the triangle in position, to the Visibility Factor determined less the triangle. The greater the value of the Triangle Visibility Ratio the lower the reduction in visibility caused by specular reflections from the triangle.

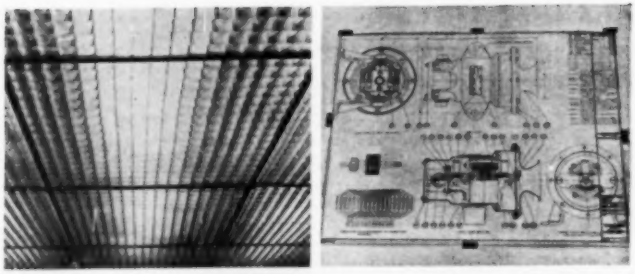
For purposes of comparison, both the Percent Maximal Visibility and the Triangle Visibility Ratios have been additionally shown in per cent of the corresponding values under translucent panels equalling 100 per cent.

In studying Table II it should be held in mind that the areas on the drawing board which coincide with the zonules of reflected glare constitute a minor percentage of the entire board area. With the 90° vane system using three lamps per reflector as an example, a mirror plot of these zonules indicate that 88 per cent of the drawing board falls in the zone of no reflected glare, with the remaining 12 per cent in locations where reflected brightness might possibly be objectionable.

Considering the various systems operated with three lamps per reflector there is, generally speaking, small difference as far as Percent Maximal Visibility is concerned in both the zonule of reflected glare and the zone of no reflected glare. The combination using opal covers on all reflectors had a lower PMV than the other systems due to its reduced utilization efficiency. As shown, the Percent Maximum Visibilities of the 90° vane louvers, both with and without the addition of a translucent panel over the center louver, were slightly higher than the translucent panel system, while the remainder were slightly lower.

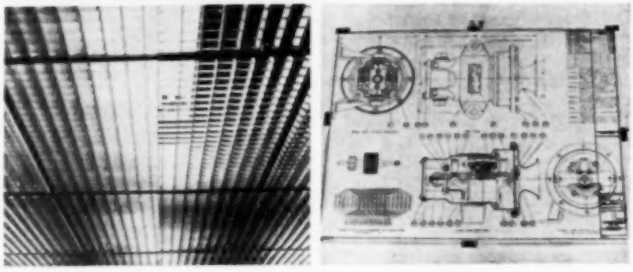
The Triangle Visibility Ratio of the 90° vane

90° VANE TRANSLUCENT LOUVERS (3 LAMP)

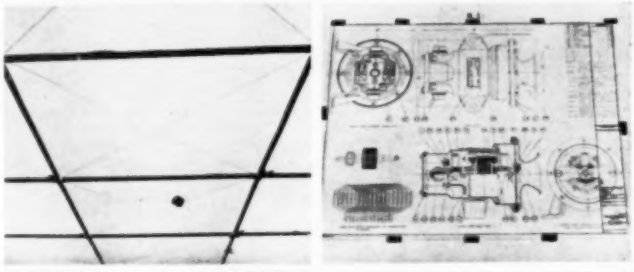


45° VANE TRANSLUCENT LOUVERS (3 LAMP)

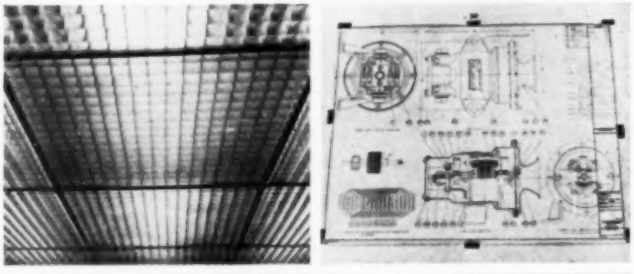
NOTE - CEILING VIEW SHOWS APPEARANCE FROM OPPOSITE DIRECTIONS.



TRANSLUCENT PANELS (3 LAMP)



90° VANE TRANSLUCENT LOUVERS WITH TRANSLUCENT PANEL OVER CENTER LOUVER (3 LAMP)



90° VANE TRANSLUCENT LOUVERS (2 LOW-BRIGHTNESS LAMPS)

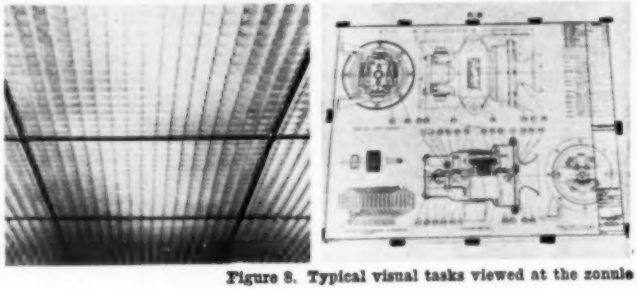
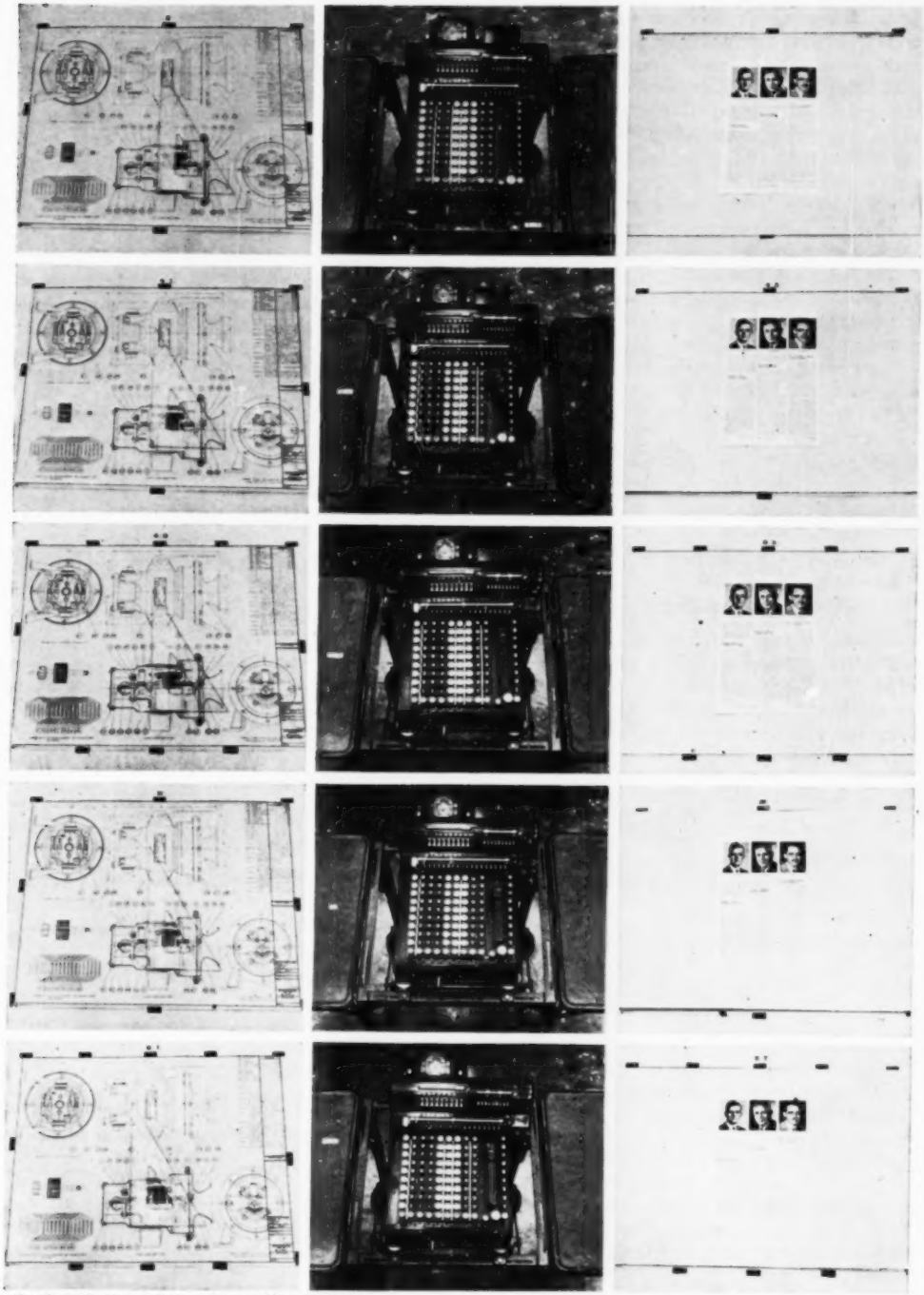


Figure 8. Typical visual tasks viewed at the zonule



of reflected glare using various ceiling elements.

louver system (three lamp) in the zonule of reflected glare was not quite 10 per cent less than with the translucent panel system. This means that when the draftsman views the visual task through the triangle he will find that 12 per cent of the drawing board has approximately 10 per cent less visibility with the 90° vane louver system than with the translucent panels. The *average* Triangle Visibility Ratio for the board, however, is about one per cent higher for the 90° vane louver system than for the panels.

The 90°vane louver system with the addition of the translucent panel over the center louver was, in the authors' opinion, the best of the combinations tested.

The two and one lamp series show greater relative differences in the Percent Maximal Visibilities with higher Triangle Visibility Ratios for the 90° vane louver system.

The use of low brightness lamps with the 90° vane louver system stands out remarkably well in the two-lamp series though it was not possible, unfortunately, to have a comparison in the three-lamp series.

Comparison of Systems—Discomfort Due to Direct Glare

In order to offer a comparison of several of the more representative systems from the standpoint of observer discomfort due to direct glare, a number of Glare Ratings[5] were computed for the three-lamp per reflector series. The brightness measurements used and the calculations involved were based on the observer being seated at the drawing board. A horizontal line of sight was assumed.

The following results were determined:

90° Vane Translucent Louvers — glare rating of 3.0

45° Vane Translucent Louvers — glare rating of 2.4

Translucent Panels — glare rating of 3.1

90° Vane Translucent Louvers (opal covers on all reflectors) — glare rating of 2.1

From the standpoint of discomfort due to direct glare, the 90° vane translucent louver system and the translucent panel system were about equal, while the 45° vane system and the 90° vane system with opal covers on all reflectors were comparable. The combination systems were not rated since it can be predicted that they would be very close to the 90° vane translucent louver system.

The fact that all of the systems checked had glare ratings well below the maximum (15) considered to indicate comfort leads to the conclusion that, under the conditions of the test, all of the systems had remarkable freedom from discomfort due to direct glare.

Comparison of Systems—Photographically

In order to provide the reader with something more than a collection of numerical data, the last method of comparison was through the medium of the camera. In Fig. 8 are shown various visual tasks as might be found in a drafting room and photographed under certain of the systems discussed in earlier portions of this paper. Reading from left to right for each system is a view of the ceiling element; a typical visual task consisting of a blackline print viewed under tracing (pencil) cloth; the same task with a triangle placed at the zonule of reflected glare; a typical business machine substituted for the drawing board; and a page extracted from ILLUMINATING ENGINEERING. All photographs were taken with identical locations for both camera and task.

Referring to the photographs of the business machine, it should be pointed out that the example used is typical of the older types which have a glossy black finish almost mirror-like in quality. The more modern machines, in order to avoid specular reflections, have finishes both lighter in color and considerably more matte in appearance. For purposes of comparison, however, the worst condition was illustrated in order to show how little difference there actually is.

It is apparent that the illustrations in Fig. 8 bear out quite closely the results previously described.

Summary

The importance of good visibility cannot be gainsaid. This is especially true in drafting rooms where the visual tasks are generally severe. The visual task selected for this study was one quite representative of such practice.

Under the conditions of the test there was not a great deal of difference between the majority of systems on trial. This was further borne out by actual visual comparisons.

The outstanding example of the various systems under test was the 90° vane translucent louver system using the 40-watt, low brightness fluorescent lamp. This system was consistently at, or near, the top in its every comparison.

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3. Luckiesh, M.: "Light, Vision and Seeing," D. Van Nostrand Co., Inc., New York City, 1944.

4. Luckiesh, M. and Moss, F. K.: "Reading as a Visual Task," D. Van Nostrand Co., Inc., New York City, 1942.

5. Harrison, W. and Meaker, P.: "Further Data on Glare Ratings," ILLUMINATING ENGINEERING, Vol. XLII, p. 153 (February, 1947).

DISCUSSION

R. L. Oetting*: The authors are to be commended for their thorough description of test conditions and materials. It is possible to make intelligent evaluation of their work and to compare it with well-documented reports of others.

The data presented in Table II are quite impressive when shown graphically (Fig. A). In this form, they clearly support the authors' conclusions with regard to the superiority of the vertical blade louvers used in conjunction with *low brightness* sources. The "footcandle effectiveness" of this system in developing task visibility is equal to that of the 45° blade system and should be more practical from the standpoints of fabrication, maintenance, and utilization. Both produced higher task visibility per footcandle than did the more diffuse translucent panel.

The utilization of the 45° blade system should be measurably improved by the modifications suggested by the authors, and by a redistribution of light sources to offset the "pile up" of illumination at one end of the small test room. The distribution of light through tilted blades should be excellent for vertical drafting boards and, should the authors have even limited data in this regard, they would be valuable contributions.

When the authors moved their test task from the potential glare position to the so-called "no reflected glare" position, the improvement in visibility was insignificant with practically all systems. It is essential to note this fact since it indicates that average system brightness may well exceed the importance of the fluorescent lamp brightnesses. The greatest change occurred with the 90° blade louvers and the 40-watt, T-12 lamps. The increases in PMV values of 5.6, 3.4, and 2.7 percentage points for 44.2, 88.9, and 126.8 footcandles, respectively, indicate very clearly that source brightness becomes a diminishing factor with increases in illumination. This conclusion is also supported by the apparent convergence of the curves plotted from data in Table II.

Once the importance of overall system brightness is recognized, the desirability of reducing candlepower at the more nearly horizontal angles will be appreciated. Reports on the few experimental installations in the 100-200 footcandle range have often included comments regarding a surface sheen or low-order overall glare on the work. Preliminary studies of the characteristics of task surfaces by O. P. Meaker suggest the effect will be particularly noticeable with high-diffusion lighting systems. His work opens a whole new field of investigation which promises to extend our knowledge of reflection characteristics and permit designs in the higher illumination ranges with assurance of comfort. The extension of visibility studies initiated by the authors to include systems with less diffuse output characteristics will be another major contribution.

Many give no heed to the factors of voltage and temperature in fluorescent lighting tests. It is assuring, therefore, to find that they were considered and controlled in this instance. In spite of these precautions, the data in Table II indicate increased efficiency and utilization in some cases with additional lamps. For instance, 80.2 footcandles were obtained with the translucent panels using two lamps per reflector. When three lamps were used, 122.2 footcandles were measured — an increase in excess of 50 per cent. Other photometric tests, including those reported in "Design and Illumination Characteristics of Louver and Louverall Systems," have indicated a loss in efficiency and utilization as lamps were added to a cavity or reflector of fixed size.

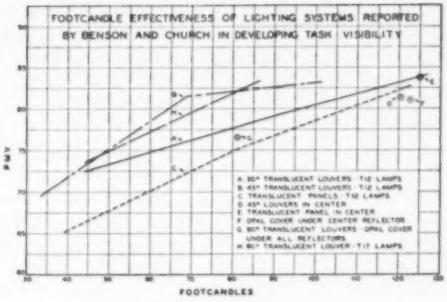

FOOTCANDLE EFFECTIVENESS OF LIGHTING SYSTEMS REPORTED BY BENSON AND CHURCH IN DEVELOPING TASK VISIBILITY
FOOTCANDLES

Figure A.

To avoid any confusion, it should be pointed out that the extremely low glare ratings of 2 and 3 apply for a room equivalent to about 8 feet in length and 15 feet 6 inches wide. This assumes the point of observation (at the drafting table) is in about the center of the test space. The authors' predictions of ratings for rooms more typical of large office areas would be useful.

Hugh F. Carroll*: Mr. Benson and Mr. Church are to be commended on their fairness in their approach to the problem on "The Effects of Luminous Ceiling Elements on Visibility." Surely no person can argue that the task selected for their study was not sufficiently difficult. There may be a question as to "why" all of these or only these ceiling elements or combinations of ceiling elements were used in their study, but even in this matter sufficient information is supplied that one can make relative comparisons from the data at hand.

Personally, I am not overly enthused with the combination of luminous and louverall panels as this adds to maintenance costs, another problem with which I am concerned. However, in the comparison between the luminous ceiling and the louverall ceiling (I'm inclined to review this paper as a continuation of that discussion) and judging from the comparative glare ratings, one could almost balance quality and quantity and choose their ceiling for economic reasons or for the aesthetic value, if the task is on the horizontal plane.

It could be expected that results would follow a similar pattern if the task is on the vertical plane, and I am sure that Messrs. Benson and Church only neglected this study because of the limited application. At the present time we are having a study conducted for glare ratings where the task is on the vertical plane and where

*General Electric Company, Nela Park, Cleveland, Ohio.

*Pennsylvania Power & Light Company, Allentown, Pa.

a luminous ceiling and a louverall ceiling are involved. The vertical intensity from the luminous ceiling is about 15-18 sq. ft-c and from the louverall ceiling 4-45 ft-c.

The results of the study show a negligible difference in the glare rating after adjusting vertical intensities to the same quantities.

PARRY MOON*: The work of Messrs. Benson and Church is a praiseworthy attempt to extend our knowledge of what constitutes ideal lighting. Several test methods are used, but the results are about the same for a rather wide variety of lighting systems. In other words, a brightness ratio of 2 or 3 does not seem to be any better than a brightness ratio of 50 or 100.

Does this mean that the S.Q.Q. Committee is wrong in advocating low brightness ratios? I don't think so: I believe that the paper proves merely that *we have not yet developed objective tests sufficiently sensitive.*

The problem is like the one encountered in trying to prove that a large amount of light is better than a small amount. Nearly everyone agrees that 100 lumens per square foot of daylight provides more comfortable conditions for seeing than 10 lumens per square foot. Yet years of research with the widest variety of test methods (from factory production tests to blink tests) have failed to give any satisfactory scientific *proof* that this is true. Nevertheless, we *know* that more light is beneficial and we act accordingly.

Similarly, in the more subtle programs of lighting *quality*, we have not yet developed test methods that are sufficiently sensitive to show what we know to be true. We know that a low brightness ratio (that is, an absence of glare) provides a better environment for human beings than a high brightness ratio. And we continue to act in accordance with this intuitive knowledge, despite the ambiguous results of present scientific tests.

BENJAMIN SCOTT BENSON, JR., AND E. H. CHURCH**: The authors wish to express their appreciation to the discussors for their constructive comments.

Mr. Carroll very wisely considers the subject of maintenance in regard to luminous panels and louvered ceilings. Louvered systems in operation for periods of a year or longer without benefit of maintenance have shown but very little dust collection on the vanes even in relativley dirty atmospheres. One has only to inspect a few enclosed skylights in order to visualize the maintenance problem occurring with luminous panels.

Both Mr. Carroll and Mr. Oetting have made mention of illumination on vertical surfaces. This subject is of great importance as it exercises a considerable influence on seeing. With the authors' particular problem, however, reflected glare was most likely to be encountered on horizontal, or near horizontal, surfaces. The most severe conditions were used for the investigation.

Mr. Oetting has called attention to the fact in regard to possible reflected glare that the effect of *average* system brightness may outweigh individual fluorescent lamp brightnesses. This can be illustrated by a study of the Triangle Visibility Ratios (TVR) for the three-lamp operation series. The TVR for the 90° vane louvers was slightly lower than that of the translucent panels in the zonule of possible reflected glare and slightly higher in the zone of no reflected glare. The *weighted* average on the drawing board indicated that the reduction in visibility occasioned by specular reflections from the triangle was 1½ per cent less for the louvers than for the translucent panels.

The seeming discrepancy in utilization efficiency was occasioned primarily by the method of test selected in order to arrive at truer relative average values (Table I). Since the lighting equipments and lamps were identical throughout each series the relative values for the visibility studies were not affected.

As pointed out in the paper, the glare ratings were based on the observer being seated at the drawing board which was located near the center of the room. To be more exact, the equivalent would be a room 15 ft. 6 inches wide by 9 ft. 3 inches long with the observer seated in a doorway. In a previous study of translucent louver systems[1] a glare rating of 6 was calculated for a room 32 feet wide, 25 feet long, 9 ft. 9 inches from floor to bottom of louvers, and illuminated to an average of 116 footcandles. A horizontal line of sight was assumed for an observer located at the rear of the room.

There is no variance of opinion between the authors and Professor Moon as to the S.Q.Q. Committee's advocation of low brightness ratios. The difference is primarily one of interpretation. When Professor Moon speaks of brightness ratios of 50 to 100 he is including the brightness of the bare fluorescent lamp regardless of how well shielded it is. These high values can scarcely be considered applicable to the systems investigated except for the reverse viewing of the louvers having vanes tilted at 45° (Fig. 8).

The S.Q.Q. Committee can hardly be said to rule out direct components of illumination when they say in their Report No. 1[2] that, ". . . additional light can be supplied to the visual task by a non-glaring direct component of light." In their Report No. 3[3] the Committee's calculation of brightness ratios in a directly lighted room does not include the source brightness. That this was intentional is attested by their statement that, "We have assumed that the light sources are so well louvered that they do not introduce glare." Certainly there can be little doubt as to the intent of these statements.

Professor Moon's desire for more sensitive objective tests is undoubtedly that of everyone concerned. Until such methods are developed, however, it would seem reasonable to at least tentatively accept the results of the really excellent instruments available today and the techniques developed to make their use objective.

*Massachusetts Institute of Technology, Cambridge, Mass.
**Authors.

1. Benson, Benjamin S., Jr.: "Louverall Lighting Techniques," ILLUMINATING ENGINEERING, Vol. XLIV, p. 89 (February, 1949).

2. "Brightness and Brightness Ratios," Report No. 1 of the Committee on Standards of Quality and Quantity for Interior Illumination of the Illuminating Engineering Society, ILLUMINATING ENGINEERING, Vol. XXXIX, p. 713 (December, 1944).

3. "Interreflection Method of Predetermining Brightness and Brightness Ratios," Report No. 3 of the Committee on Standards of Quality and Quantity for Interior Illumination of the Illuminating Engineering Society, ILLUMINATING ENGINEERING, Vol. XLI, p. 361 (May, 1946).

Lighting A High-Ceiling Office

LIGHTING OBJECTIVE: To provide lighting for the exacting tasks performed in a newspaper editorial office.

Installation at *Chicago Daily Tribune* News Room, 435 North Michigan Avenue, Chicago

General Information: Colors and estimated reflection factors of this 72′ x 57′ x 25′ room are indicated below:

	R. F.	*Color*
Desks	15%	Dark green
Files	15%	Dark green
Office Machinery	8%	Black
Walls (above dado)	45%	Apple green
Dado	20%	Dark green
Ceiling	55%	Light buff
Floor	12%	Mottled maroon

The windows are all painted over; *i.e.*, there is no daylighting.

(over)

A.I.A. File No. 31/14

Installation: Fifty-four Curtis #4061-C louvered semi-direct luminaires each containing two 85-watt daylight fluorescent lamps provide an average illumination of 34 footcandles after two years of operation (approximately 18,000 hours) and at the end of a three-month maintenance period (just before cleaning and relamping). All room surfaces were very dirty at the time the measurements were made. The luminaires are spaced on 11½-foot centers and mounted 24 feet above the floor.

Brightness values are as follows:

Desks		
maximum	3.2	footlamberts
minimum	2.1	"
Files	2.0	"
Ceiling		
maximum	75	"
minimum	7	"
Front Wall (wall with clock in photograph)		
upper	7.5	"
middle	7.5	"
Right Side Wall		
upper	6.0	"
middle	6.5	"
dado	2.0	"
Left Side Wall		
upper	3.0	"
middle	4.0	"
Floor		
maximum	3.5	"
minimum	2.0	"
Luminaires		
45° transverse	1627	"
70° transverse	271	"
90° transverse	181	"
70° lengthwise	678	"

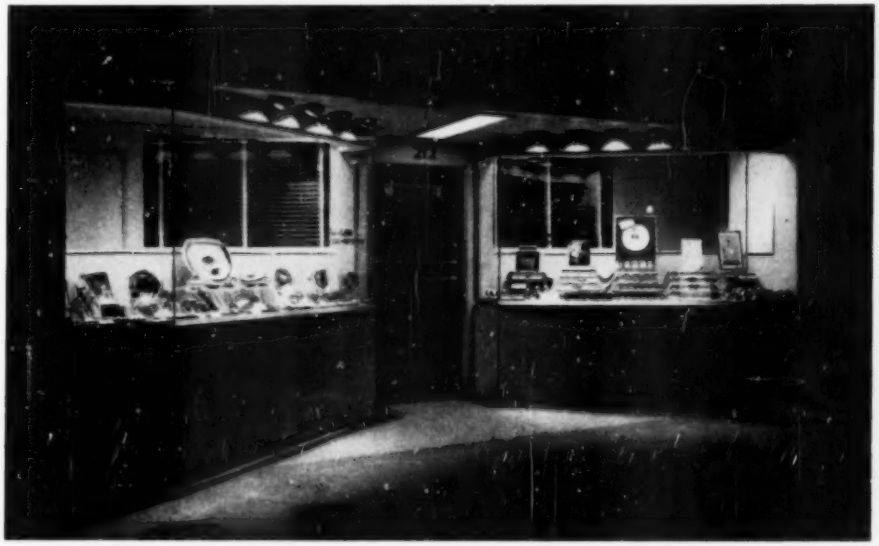
Lighting data submitted by Curtis Lighting, Inc., 6135 West 65th Street, Chicago, Illinois, as an illustration of good lighting practice and to aid in the design of similar installations.

Published by the Committee on Publications of the Illuminating Engineering Society, 51 Madison Avenue, New York 10, N. Y.

Series XIV 12-49

Lighting a Jewelry Shop Window

LIGHTING OBJECTIVE: To provide lighting under structural handicap which will (1) attract passersby to the window and (2) enhance the appearance of the merchandise.



Installation at Thad. B. Reese, Inc., Albany, Georgia

General Information: A plan view of this jewelry store window is shown in Fig. 2.

Installation: For structural reasons it was necessary to place the luminaires for general window lighting (200-watt lamps in recessed reflectors) about 13 inches behind the front window glasses. To avoid shadows cast by the open tops of jewelry boxes near the front of the windows and to highlight the jewelry, the windows were further illuminated *through the window glass* by projector spot lamps (PAR 38 150-watt spots) in adjustable units placed in the vestibule and tilted at 18°. No reflected glare from these spots can be seen by a customer standing one foot from the window glass.

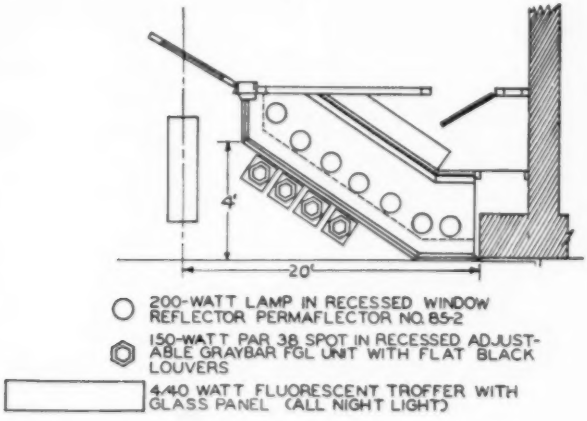

4'
20'
200-WATT LAMP IN RECESSED WINDOW REFLECTOR PERMAFLECTOR NO. 85-2
150-WATT PAR 38 SPOT IN RECESSED ADJUSTABLE GRAYBAR FGL UNIT WITH FLAT BLACK LOUVERS
440 WATT FLUORESCENT TROFFER WITH GLASS PANEL (ALL NIGHT LIGHT)

Figure 2.

(over)

A.I.A. File No. 31/14

Figure 3a. (Left) Window lighted by conventional reflectors.

Figure 3b. (Right) With supplementary spotlights.

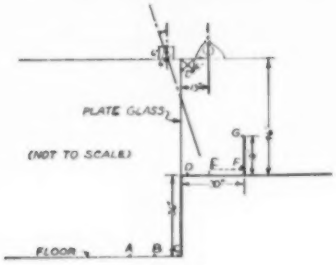


Figure 4.

Footcandle readings are as follows:

Point (See Fig. 4)	PAR 38 Only	Reflectors Only	Combination
A	80	55	135
B	100	55	155
C	80	0	80
D	50	360	410
E	400	440	840
F	100	350	450
G	10	440	450

Lighting data submitted by Tom W. Haslam, Georgia Power Company, Atlanta, Georgia as an illustration of good lighting practice and to aid in the design of similar installations.

Published by the Committee on Publications of the Illuminating Engineering Society, 51 Madison Avenue, New York 10, New York

Series XIV 12-49

Here's How Parking Lots Are Served in Detroit

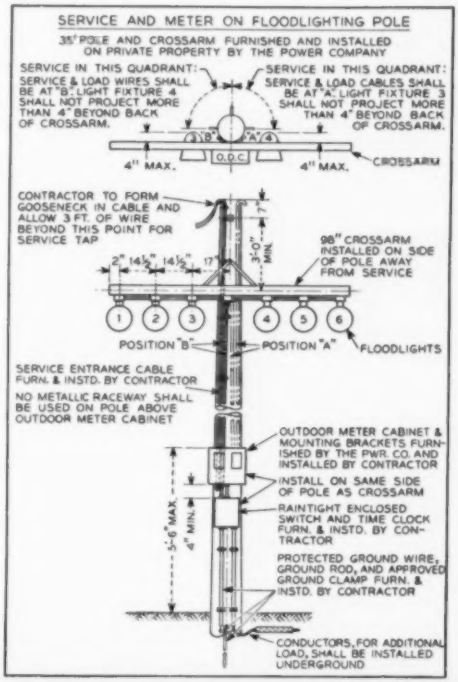
WHEN THE proprietors of parking lots in the vicinity of Briggs Stadium, Detroit, saw the floodlighting of night ballgames there, the power company immediately received numerous requests for lighting of parking lots in the area.

Since a long-standing power company rule prohibited the mounting of both metering and lighting equipment on its poles, protracted study was undertaken in conference with electrical contractors, maintenance personnel and the parking lot people themselves, resulting in a change in company policy. (See IE, July, 1949, page 436.)

Thirty-five-foot poles may now be supplied to the customer on a maintenance basis only, lamp replacements supplied by the company on request, and reflectors cleaned every four weeks for a nominal fee. The standard 6-lamp unit shown at the right can be installed, maintained, and operated three hours per night for a total cost of $1.05 per day to the customer.

In the used-car sales lot shown below, ten steel tubular combination poles and flagstaffs each carry 26 1000-watt bi-post lamps in appropriate reflectors to give some 75 footcandles on the car hoods.

Based on information furnished by Fred W. Ready of the Lighting Division, Detroit Edison Co.


SERVICE AND METER ON FLOODLIGHTING POLE
35' POLE AND CROSSARM FURNISHED AND INSTALLED ON PRIVATE PROPERTY BY THE POWER COMPANY
SERVICE IN THIS QUADRANT: SERVICE & LOAD WIRES SHALL BE AT "B". LIGHT FIXTURE 4 SHALL NOT PROJECT MORE THAN 4" BEYOND BACK OF CROSSARM.
SERVICE IN THIS QUADRANT: SERVICE & LOAD CABLES SHALL BE AT "A". LIGHT FIXTURE 3 SHALL NOT PROJECT MORE THAN 4" BEYOND BACK OF CROSSARM.
4" MAX.
O.O.C.
4" MAX.
CROSSARM
CONTRACTOR TO FORM GOOSENECK IN CABLE AND ALLOW 3 FT. OF WIRE BEYOND THIS POINT FOR SERVICE TAP
3'-0" MIN.
98" CROSSARM INSTALLED ON SIDE OF POLE AWAY FROM SERVICE
2" 14½" 14½" 17"
1 2 3 4 5 6
POSITION "B"
POSITION "A"
FLOODLIGHTS
SERVICE ENTRANCE CABLE FURN. & INSTD. BY CONTRACTOR
NO METALLIC RACEWAY SHALL BE USED ON POLE ABOVE OUTDOOR METER CABINET
OUTDOOR METER CABINET & MOUNTING BRACKETS FURNISHED BY THE PWR. CO. AND INSTALLED BY CONTRACTOR
INSTALL ON SAME SIDE OF POLE AS CROSSARM
RAINTIGHT ENCLOSED SWITCH AND TIME CLOCK FURN. & INSTD. BY CONTRACTOR
5'-6" MAX.
4" MIN.
PROTECTED GROUND WIRE, GROUND ROD, AND APPROVED GROUND CLAMP FURN. & INSTD. BY CONTRACTOR
CONDUCTORS FOR ADDITIONAL LOAD, SHALL BE INSTALLED UNDERGROUND

Experimental School Lighting in New Jersey

A TYPICAL twenty-year old classroom in the Alfred Reed School, Ewing Township, New Jersey has been transformed into a model lighting center to serve as a demonstration unit for the entire state. The lighting experiment was sponsored jointly by the Ewing Township Board of Education and the New Jersey Chapter of the Society for Crippled Children and Adults to demonstrate the application of modern trends in schoolroom illumination and to determine the effect of the resultant visual environment on the quality of schoolwork and health of the pupils. Incidentally, this installation may demonstrate the acceptability of glass block and fluorescent lamps, the use of which is now prohibited in classroom construction under the New Jersey school building code. The detailed plan for the center was drawn up and approved by such agencies as New Jersey Commission for the Blind, the State Department of Education, and the State Department of Health.

The windows in the experimental room were replaced by large areas of directional glass block with a three-foot vision strip at eye level. Since the former stamped sheet metal ceiling could not uniformly reflect the light cast upon it by the glass block, a new ceiling (made of acoustically treated material with a 90 per cent reflection factor) was installed. All surfaces in the room were refinished or replaced with the objective of attaining an ap-

Figure 1. (Above) Unplanned visual field.

Figure 2. (Right) Planned visual field.

Photos taken at night.

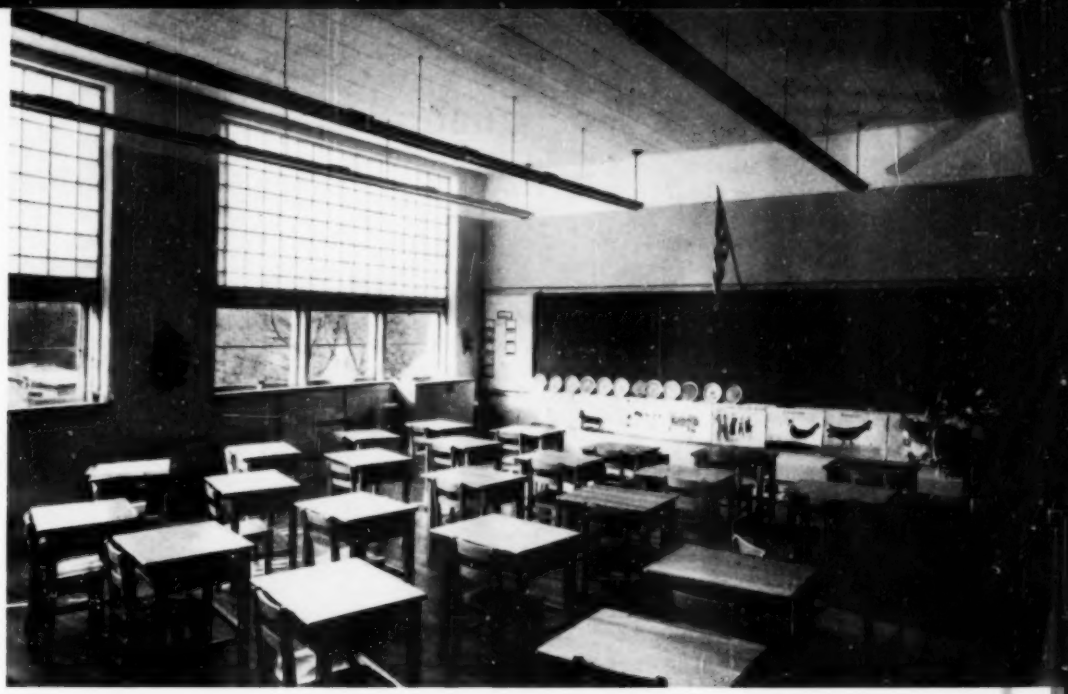


Figure 3. Planned visual field (daylight view).

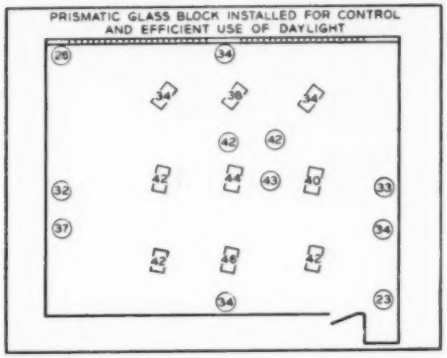


Figure 4. Illumination values—footcandle values taken with a Weston illumination meter, Model No. 603.

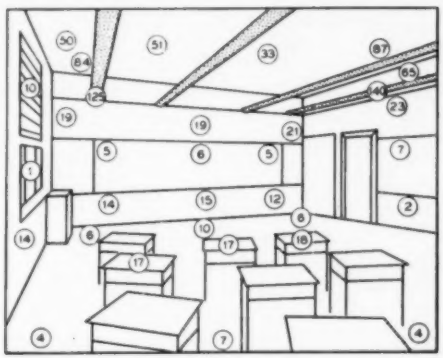


Figure 5. Brightness values — footlambert values taken with a Luckiesh-Taylor brightness meter.

proximate 3 to 1 brightness ratio in the field of view: walls were repainted to a 65 per cent reflectance (green because of its cool psychological effect), floors were scraped and refinished to a reflectance of 30 per cent, green chalkboard (27 per cent reflectance) was substituted for the old slate board, and dark desks and chairs were replaced by light blond furniture (30 per cent reflectance). In addition, seating was rearranged to permit each child to face at least 50 degrees away from the line between him and the front left corner of the room.

Four continuous rows of semi-indirect luminaires, each containing two 40-watt fluorescent lamps provide the illumination values shown in Fig. 4, well over the 30 footcandles recommended in the "American Standard Practice for School Lighting." Brightness readings recorded at night are shown in Fig. 5.

Application of Recommended Brightness Limitations To School Rooms

By F. C. WINKLER
JOHN J. NEIDHART

The new American Standard Practice for School Lighting establishes two important standards — minimum illumination levels and maximum permissible luminaire brightnesses. This paper describes the effect of these standards upon school lighting practice and analyzes their practicability. Illumination levels of 30 footcandles as prescribed by the Standard are easily obtained with current luminaire designs, but the brightness limitations will in most cases necessitate major luminaire revisions. This paper discusses revisions necessary to meet the Standard, showing their effect on luminaire distribution, efficiency, cost, and application.

TODAY in America our school rooms are being lighted with equipment selected by architects, school officials, utility men and lighting engineers. This equipment ranges all the way from luminaires using exposed incandescent or fluorescent lamps to totally indirect luminaires. Obviously, all of this equipment cannot possibly produce optimum illumination for the eyes of young America. One of the reasons advanced for the selection of such diverse equipment has been the lack of suitable general standards to follow. The new American Standard Practice for School Lighting, Approved September 20, 1948, establishes not only the required illumination levels but in addition prescribes recommended brightness limits for lighting equipment.

Before this new Standard can be universally accepted by those in a position to specify lighting equipment, its effect upon current practice must be thoroughly understood, and they must be convinced of its practicability. To determine its effect upon present-day practice, designs now in use were investigated to ascertain their ability to comply with the Standard.

Some designs using low brightness 40-watt or low current Slimline lamps and some semi-indirect luminaires were found to be suitable. However, in most cases their economic feasibility is subject to question—particularly when one realizes that most schools must operate on limited budgets.

After making a complete cost analysis of all practical light sources for classroom lighting, the 40-watt, 48", T-12, bipin lamp was selected as being representative of all sources. The following discussion and data is, therefore, based upon equipment designed solely for these lamps.

Paragraph 4.2.3.4 of the new Standard Practice with which this paper is concerned reads as follows:*

Brightness Limitations — As a guide in luminaire selection for the range of footcandles given in the table of lighting levels (Table II), the *brightnesses* in Table IV are *recommended as maximum values both crosswise and lengthwise* of the luminaire. Observance of these limits should avoid glare from luminaires under any normal circumstances of installation and room decoration. However, it is recognized that *higher values* than these have been *used without detriment* in installations where great care was taken to use light colors and matte finishes in the lower part of the room as well as in the upper part and where the bright areas of the luminaires are small. (See General Bibliography 43 and 57.) It is recommended that where such conditions permit the use of luminaires of other than the indirect or semi-indirect types, APPROXIMATELY *double* the *values* given *be accepted* as the limits of brightness.

TABLE IV of American Standard Practice of School Lighting.

Zone (0° is directly beneath luminaire)	Recommended Brightness Limits in Footlamberts*
60° - 90°	225
45° - 60°	450
0° - 45°	1000

*Comparative values in candles per square inch, respectively, .5, 1.0, 2.

These limitations may be expressed diagrammatically as shown in Chart I. Case I shows the limits tabulated in Table IV of the Standard Practice. This has been indicated as being for the Usual Visual Environment where dark finishes and furniture prevail. The doubled limits for light finishes and furniture are shown as Case II for a Controlled Visual Environment.

A paper presented at the National Technical Conference of the Illuminating Engineering Society, French Lick, Indiana, September 20-23, 1949. Authors: Lighting Division, Engineering Dept., Westinghouse Electric Corp., Cleveland, Ohio.

*Italics are the authors'.

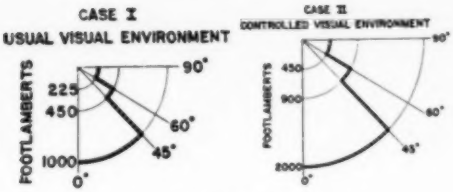


CHART I

ASA maximum recommended brightness limits.

30° x 25° Louvers

The most common fluorescent luminaire in use today in school classrooms is a direct-indirect type having a louvered bottom providing approximately 30° transverse and 25° longitudinal shielding. These louvers may be either flat or curved; and since both types provide similar photometric distributions, the more recent curved bottom type with translucent plastic side panels has been selected as the standard unit for all data in this paper.

Typical distribution curves for both two- and four-lamp units are shown in Chart II. The overall efficiency, together with the upward and downward components, should be noted. The brightnesses in the three standard zones (0-45°, 45-60°, and 60-90°) are also shown and are superimposed upon the standard curve shown as Case II of Chart I for the Controlled Visual Environment. (No louvered bottom unit can possibly satisfy the limits for the Usual Visual Environment, Case I of Chart I, since rated lamp brightness exceeds the 1000 footlambert maximum.) These brightnesses were measured in accordance with the 1948 I.E.S. Guide for the Photometric Testing of Fluorescent Luminaires which states:

> Measurements should be made of the average brightness of a one-inch square or of one square inch rectangular area with the major dimension selected to suit the particular area being measured but not exceeding four inches. The method and area measured should be stated.

Being unable to interpret the rather vague instructions for using a 1" x 1", ½" x 2" or ¼" x 4" test area, it was decided that a 1" x 1" test area would be used for all brightness measurements described herein. If other test areas are used evidence is available which indicates that the brightness values reported herein may be decidedly different. The instrument used to measure these brightnesses is fully described and illustrated in G. A. Horton's 1949 Conference Paper No. 34 entitled "Modern Photometry of Fluorescent Luminaires."

It is obvious from the brightness distribution curves that this very popular type of unit has brightnesses exceeding those of the Standard Practice and, therefore, cannot be considered to be satisfactory classroom units.

Although this luminaire does not satisfy the recommended limits in the Standard, the illumination and room brightness distributions for an installation of these luminaires in a typical 24' x 30' x 12' classroom are shown in Fig. 1 for future reference and comparison with subsequent data. The installation consists of two rows of six luminaires each and provides an average level of 50 footcandles with good maintenance. (A two-row installation of 12 four-lamp units has been established as a standard test installation for this paper because of its economic practicability and because it illustrates the effect of modifications, which will be subsequently developed, much better than would a three-row installation of two-lamp units.) It can be seen that two rows of 4-lamp units having a predominant upward component and 30° transverse louvers provide satisfactory uniformity across the room. Other tests showed a very poor distribution from similar luminaires with tighter louvers and a predominant downward component (Fig. 2). Thus it appeared that luminaires with the tighter shielding required to meet the Standard might preclude the use of two-row installations. This was another reason for using a two-row system as standard for all tests.

45° x 45° Louvers

One interpretation of the Standard has been that 45° x 45° louvers are required to conform with the 0-45° zonal division of brightness limits. This interpretation has been incorporated in several state codes and has led to the introduction of 45° louvers by many manufacturers.

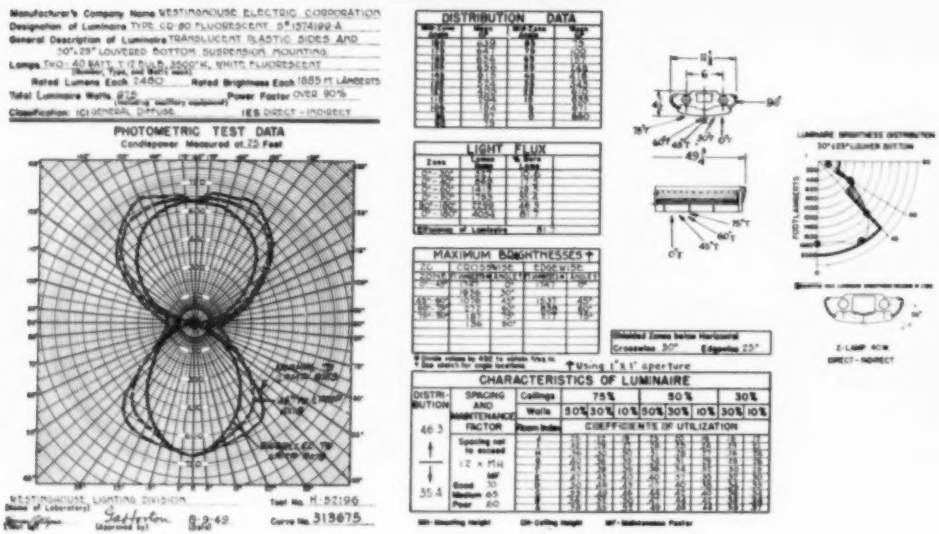
Chart III shows typical distribution curves of two- and four-lamp luminaires of the same design as used in Chart II except equipped with a 45° x 45° louver. A comparison of Charts II and III shows that the added shielding produces the following changes:

1. The distribution now becomes semi-indirect with 70% of the light upward. The upward was 57%-59% with the 30° x 25° louver.
2. The total overall efficiency is reduced from 80-82% to 68-71% — (A reduction of 15%).
3. The direct component becomes extremely narrow.
4. The coefficients of utilization are reduced approximately 23%.

Furthermore, the design of this 45° louver causes the following:

1. The increased number of cells and blades results in a weight increase of approximately 200%.

LIGHTING EQUIPMENT ENGINEERING DATA SHEET


Manufacturer's Company Name WESTINGHOUSE ELECTRIC CORPORATION
Designation of Luminaire TYPE CD-80 FLUORESCENT S*1574199-A
General Description of Luminaire TRANSLUCENT PLASTIC SIDES AND 30°x25° LOUVERED BOTTOM, SUSPENSION MOUNTING
Lamps TWO-40 WATT, T-12 BULB, 3500°K, WHITE FLUORESCENT
Rated Lumens Each 2480 Rated Brightness Each 1885 FT LAMBERTS
Total Luminaire Watts 96 Power Factor OVER 90%
Classification (C) GENERAL DIFFUSE IES DIRECT-INDIRECT
PHOTOMETRIC TEST DATA
Candlepower Measured at 72 Feet
DISTRIBUTION DATA
LIGHT FLUX
MAXIMUM BRIGHTNESSES
CHARACTERISTICS OF LUMINAIRE
WESTINGHOUSE LIGHTING DIVISION
Test No. H-52196
Curve No. 313675
Z-LAMP 40W
DIRECT-INDIRECT

LIGHTING EQUIPMENT ENGINEERING DATA SHEET

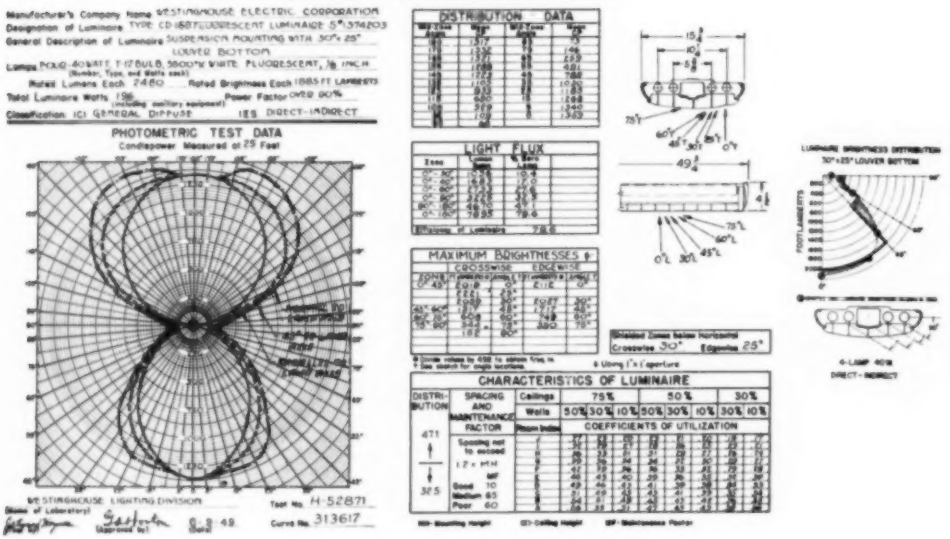

Manufacturer's Company Name WESTINGHOUSE ELECTRIC CORPORATION
Designation of Luminaire TYPE CD-160 FLUORESCENT LUMINAIRE S*1574203
General Description of Luminaire SUSPENSION MOUNTING WITH 30°x 25° LOUVER BOTTOM
Lamps FOUR-40 WATT, T-12 BULB, 3500°K WHITE FLUORESCENT, 1½ INCH
Rated Lumens Each 2480 Rated Brightness Each 1885 FT LAMBERTS
Total Luminaire Watts 196 Power Factor OVER 90%
Classification (C) GENERAL DIFFUSE IES DIRECT-INDIRECT
PHOTOMETRIC TEST DATA
Candlepower Measured at 29 Feet
DISTRIBUTION DATA
LIGHT FLUX
MAXIMUM BRIGHTNESSES
CHARACTERISTICS OF LUMINAIRE
WESTINGHOUSE LIGHTING DIVISION
Test No. H-52871
Curve No. 313617
4-LAMP 40W
DIRECT-INDIRECT

CHART II

Photometric Data

For typical 2- & 4-lamp 40W luminaires with 30° x 25° louver bottom.

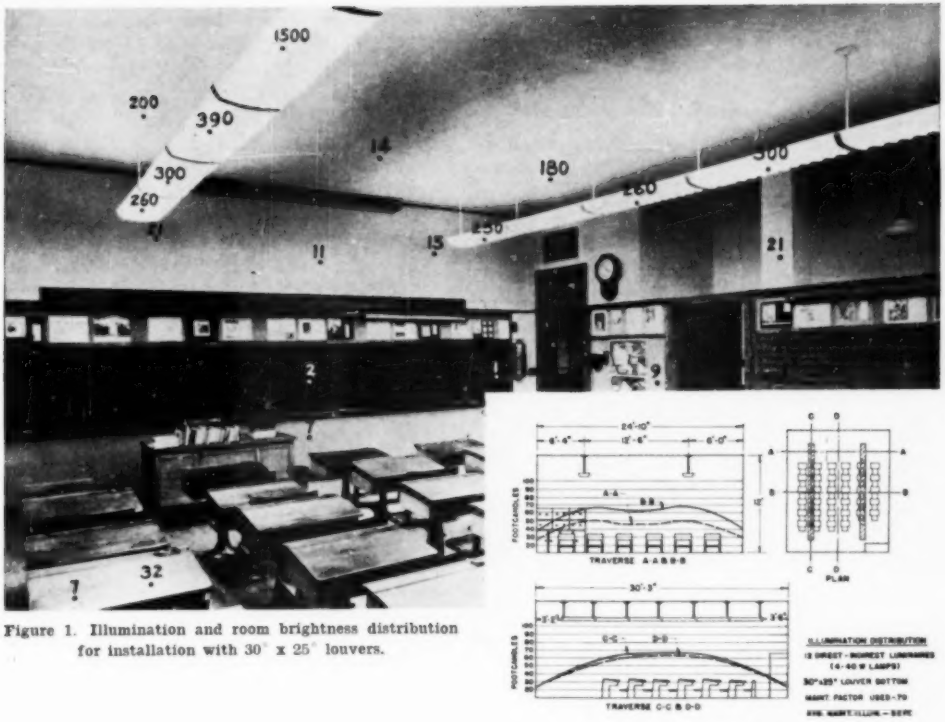


Figure 1. Illumination and room brightness distribution for installation with 30° x 25° louvers.

2. The total area of all the longitudinal and transverse blades increases 200% although the shielding angle increases only 15° x 20°.
3. Due to the increased amount of material and assembly operations the manufacturing cost increases 400%.
4. The additional blades required inherently increase the rigidity of the assembly. This is desirable, because louvers in general are subject to damage during shipment and maintenance.

The brightnesses shown in Chart III indicate that the two-lamp luminaire conforms with the

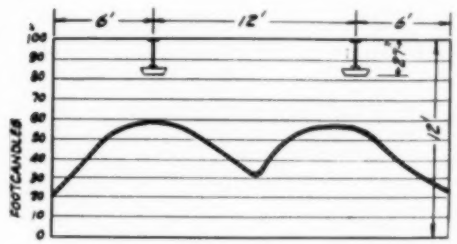
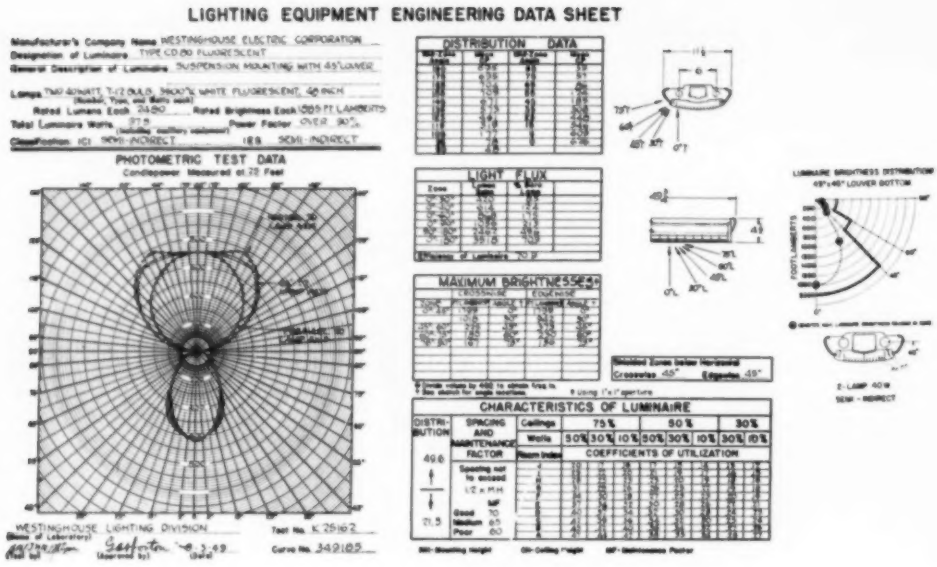


Figure 2. Illumination distribution for installation of tightly louvered luminaires with predominant downward component.

brightness limits outlined in the Standard Practice. The four-lamp unit can be construed to pass or fail depending upon one's interpretation of the word "*approximately*" in the Standard Practice statement that "*approximately double*" the 1000 foot-lambert limit in the 0-45° zone is acceptable in the Controlled Visual Environment. The fact that the brightness in this zone is greater than rated lamp brightness results from a mutual buildup in brightness between adjacent lamps and reflecting surfaces. This effect is approximately 19 per cent greater for the four-lamp unit than for the two-lamp luminaire.

The 30° x 25° louvers used in the installation previously described were replaced by 45° x 45° louvers and the illumination and room brightness distributions shown in Fig. 3 obtained. Although the direct component from the luminaire is very narrow, the illumination distribution across the room is sufficiently uniform to be acceptable. This uniformity is a result of the high percentage of upward light. The average measured illumination level is reduced from 50 footcandles to 42 footcandles maintained — a 16 per cent reduction.


LIGHTING EQUIPMENT ENGINEERING DATA SHEET
Manufacturer's Company Name WESTINGHOUSE ELECTRIC CORPORATION
Designation of Luminaire TYPE CD 160 FLUORESCENT
General Description of Luminaire SUSPENSION MOUNTING WITH 45° LOUVER
Lamps TWO 40 WATT, T-12 BULB, 3500°K, WHITE FLUORESCENT, 48 INCH
Rated Lumens Each 2480 Rated Brightness Each 1205 FT. LAMBERTS
Total Luminaire Watts 87.5 Power Factor OVER 90%
Classification IES SEMI-INDIRECT IES SEMI-INDIRECT
PHOTOMETRIC TEST DATA
Candlepower Measured at 25 Feet
DISTRIBUTION DATA
LIGHT FLUX
MAXIMUM BRIGHTNESSES
CHARACTERISTICS OF LUMINAIRE
WESTINGHOUSE LIGHTING DIVISION
Test No. K 25162
Curve No. 349185
LUMINAIRE BRIGHTNESS DISTRIBUTION
45°x45° LOUVER BOTTOM
2-LAMP 40 W
SEMI - INDIRECT

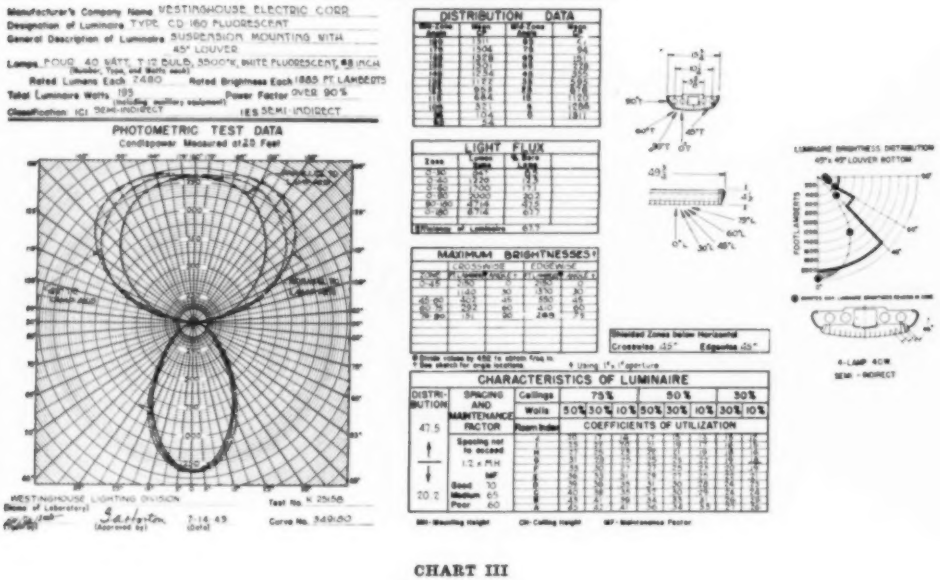

LIGHTING EQUIPMENT ENGINEERING DATA SHEET
Manufacturer's Company Name WESTINGHOUSE ELECTRIC CORP.
Designation of Luminaire TYPE CD 160 FLUORESCENT
General Description of Luminaire SUSPENSION MOUNTING WITH 45° LOUVER
Lamps FOUR 40 WATT, T-12 BULB, 3500°K, WHITE FLUORESCENT, 48 INCH
Rated Lumens Each 7480 Rated Brightness Each 1885 FT. LAMBERTS
Total Luminaire Watts 195 Power Factor OVER 90%
Classification IES SEMI-INDIRECT IES SEMI-INDIRECT
PHOTOMETRIC TEST DATA
Candlepower Measured at 25 Feet
DISTRIBUTION DATA
LIGHT FLUX
MAXIMUM BRIGHTNESSES
CHARACTERISTICS OF LUMINAIRE
WESTINGHOUSE LIGHTING DIVISION
Test No. K 25156
Curve No. 349160
LUMINAIRE BRIGHTNESS DISTRIBUTION
45°x45° LOUVER BOTTOM
4-LAMP 40 W
SEMI - INDIRECT

CHART III

Photometric Data

For typical 2- & 4-lamp 40W luminaires with 45° x 45° louver bottom.

Comparing the room brightness distribution shown in Fig. 1 with that of Fig. 3, it is evident that the greatest difference between the brightness patterns from the two installations occurs in the left hand row of units. Here the luminaire brightnesses near the front of the room are similar in both cases (although slightly higher for the 45° louver); but as the eye progresses toward the rear of the row, the brightnesses are materially lower for the installation of 45° louvers. The increased seeing comfort resulting from these lower brightnesses was readily apparent to trained observers viewing the installations.

X° Louvers

Actually, the Standard Practice does not recommend any specific shielding angles. It merely limits brightnesses to certain values in three angular zones. The shielding required to conform with these limits can be determined only by extensive photometric experimentation. This can be accomplished by taking brightness readings as the width and location of the blades are varied over small intervals until the brightness limit is reached. The resulting louver will have a variety of shielding angles transversely and will, therefore, be hereinafter referred to as the X° Louver.

Chart IV shows typical distribution curves of 2- and 4-lamp luminaires of the same design used for data previously discussed, except equipped with the new American Standard Practice X° Louver for Classroom Lighting. Comparing Charts II, III, and IV the following points should be noted:

1. The distribution is semi-indirect with 68% of the light in the 90-180° zone. This is slightly less than the upward component of the 45° louvered unit.
2. The total overall efficiency of the X° louvered unit is 74-75%. This is only 5% less than the 30° louvered unit efficiency but is *10%* more than that of the 45° louvered unit.
3. The direct component is narrower than the 30° unit but wider than the 45° unit, which leads to improved illumination uniformity in actual installations.
4. The utilization coefficients are 16% lower than the 30° yet 12% *higher* than the 45°.

Other advantageous features of the X° Louver over the 45° Louver include:

1. Fewer and larger cells reduce the total weight by 41% and simplify maintenance. This reduction does not materially reduce the rigidity.

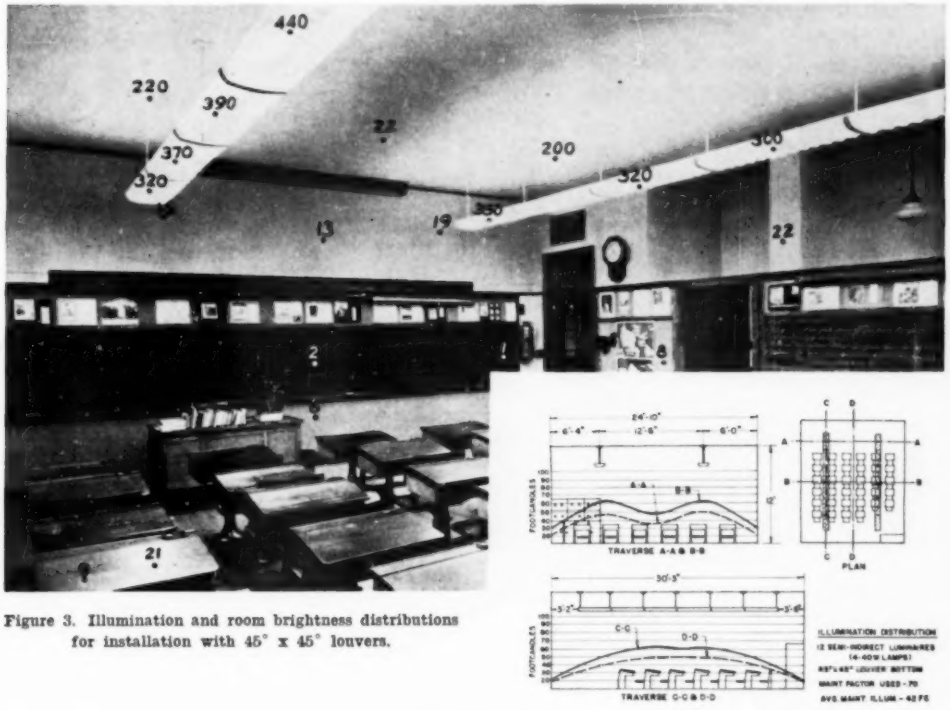
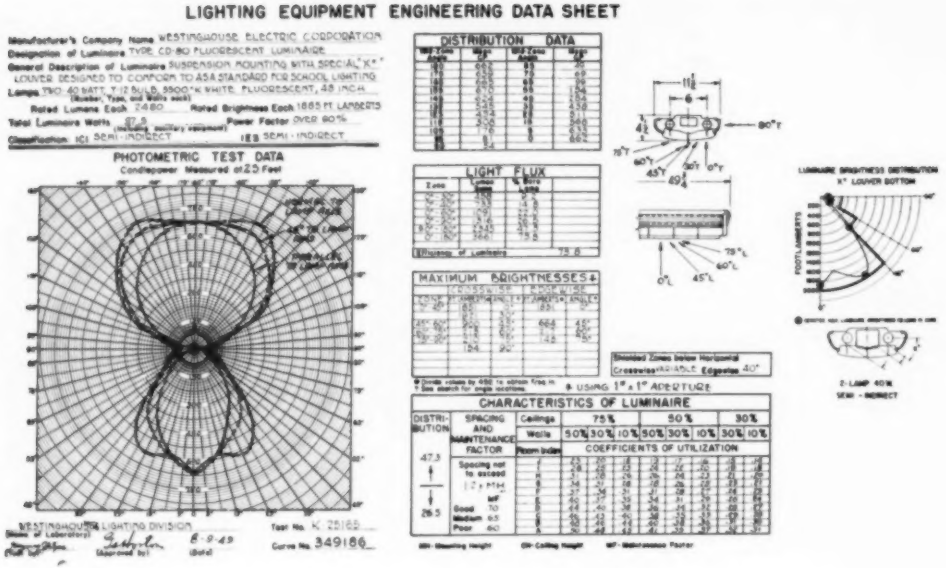


Figure 3. Illumination and room brightness distributions for installation with 45° x 45° louvers.


LIGHTING EQUIPMENT ENGINEERING DATA SHEET
Manufacturer's Company Name WESTINGHOUSE ELECTRIC CORPORATION
Designation of Luminaire TYPE CD-80 FLUORESCENT LUMINAIRE
General Description of Luminaire SUSPENSION MOUNTING WITH SPECIAL "X" LOUVER DESIGNED TO CONFORM TO ASA STANDARD FOR SCHOOL LIGHTING
Lamps TWO 40 WATT T-12 BULB, 3500°K WHITE, FLUORESCENT, 48 INCH
Rated Lumens Each 2480 Rated Brightness Each 1885 FT. LAMBERTS
Total Luminaire Watts 87.5 Power Factor OVER 90%
Classification IES SEMI-INDIRECT
PHOTOMETRIC TEST DATA
Candlepower Measured at 25 Feet
DISTRIBUTION DATA
LIGHT FLUX
MAXIMUM BRIGHTNESSES
CHARACTERISTICS OF LUMINAIRE
Test No. K 25165
Curve No. 349186
LUMINAIRE BRIGHTNESS DISTRIBUTION
X° LOUVER BOTTOM
2-LAMP 40 W
SEMI - INDIRECT

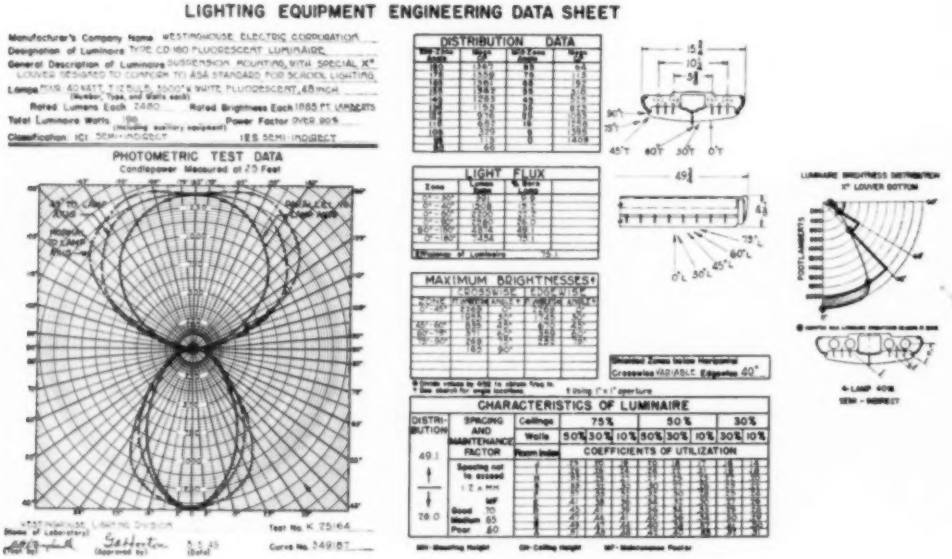

LIGHTING EQUIPMENT ENGINEERING DATA SHEET
Manufacturer's Company Name WESTINGHOUSE ELECTRIC CORPORATION
Designation of Luminaire TYPE CD-180 FLUORESCENT LUMINAIRE
General Description of Luminaire SUSPENSION MOUNTING WITH SPECIAL "X" LOUVER DESIGNED TO CONFORM TO ASA STANDARD FOR SCHOOL LIGHTING
Lamps FOUR 40 WATT T-12 BULB, 3500°K WHITE, FLUORESCENT, 48 INCH
Rated Lumens Each 2480 Rated Brightness Each 1885 FT. LAMBERTS
Total Luminaire Watts 196 Power Factor OVER 90%
Classification IES SEMI-INDIRECT
PHOTOMETRIC TEST DATA
Candlepower Measured at 25 Feet
DISTRIBUTION DATA
LIGHT FLUX
MAXIMUM BRIGHTNESSES
CHARACTERISTICS OF LUMINAIRE
Test No. K 25164
Curve No. 349187
LUMINAIRE BRIGHTNESS DISTRIBUTION
X° LOUVER BOTTOM
4-LAMP 40 W
SEMI - INDIRECT

CHART IV

Photometric Data

For typical 2- & 4-lamp 40W luminaires with X° louver bottom.

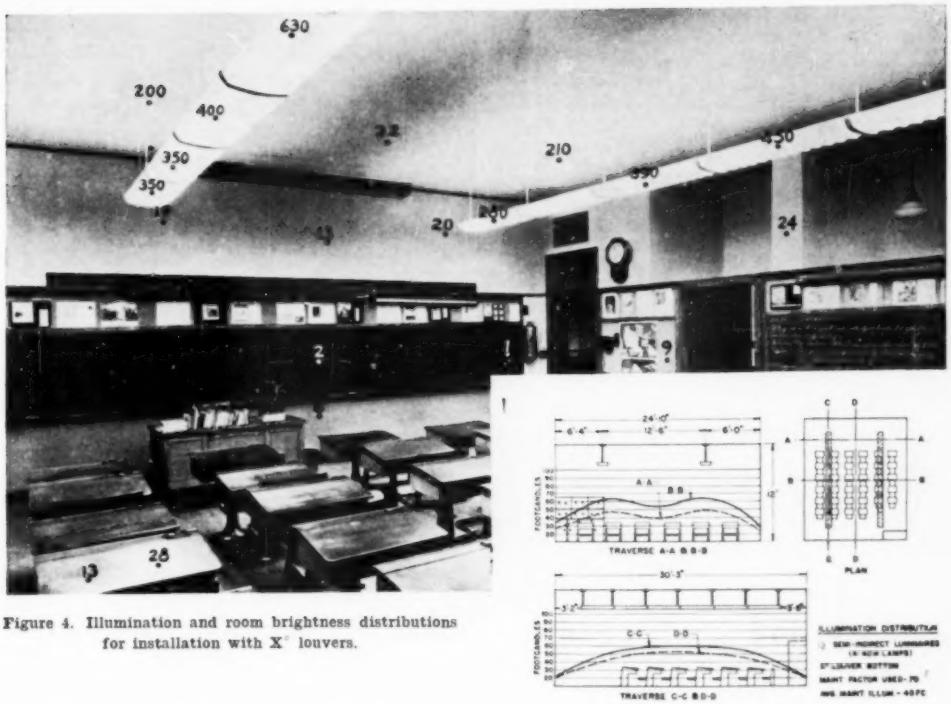


Figure 4. Illumination and room brightness distributions for installation with X° louvers.

2. The total area of all longitudinal and transverse blades is 41% less which results in the 10% increase in efficiency mentioned above.
3. The manufacturing cost is reduced 75%.

The brightnesses shown in Chart IV conform with the brightness limits recommended in the Standard Practice for the two-lamp luminaire. The four-lamp unit also conforms with the Standard Practice limits except in the 0-30° zone where mutual buildup of brightness between adjacent lamps and reflecting surfaces causes the brightness of the lamp to exceed the 2000 footlambert limit.

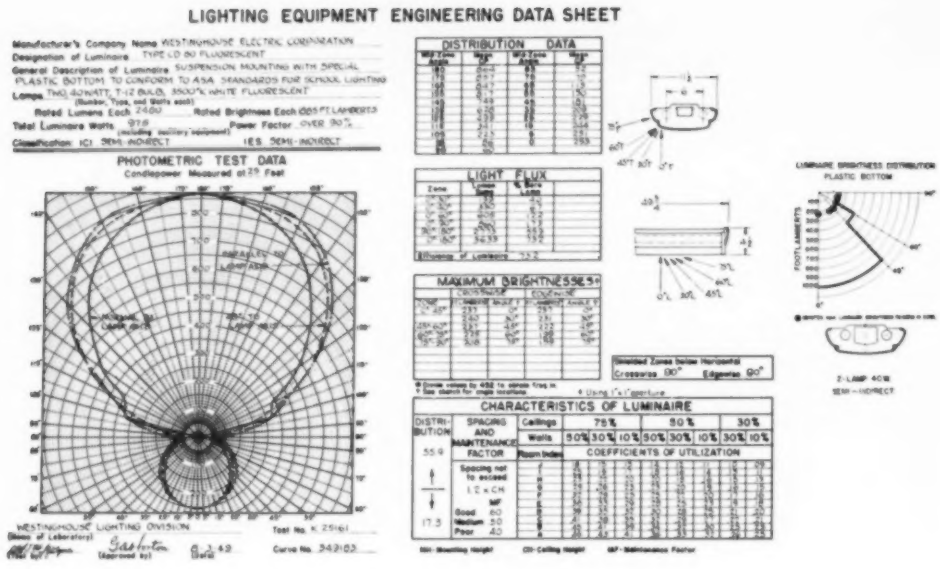
With the test installation equipped with X° Louvers, the illumination and room brightness distributions shown in Fig. 4 resulted. The uniformity of the distribution across the room is noticeably improved over that obtained with the 45° louvers. The average maintained illumination level was 45 footcandles — (an 8 per cent improvement over the 45° louver). It can be seen that the room brightnesses are comparable to those obtained with the 45° louver installation. The installation was given a high seeing comfort rating by trained observers who believed that the overall appearance was better than that of the installation with 45° louvers.

Plastic Bottoms

Up to this point only luminaires for the Controlled Visual Environment condition (Case II of Chart I) have been discussed. To satisfy the requirements of Chart I, Case I, it is necessary to completely shield the lamp from direct view. For this analysis a translucent plastic bottom was employed in the *same luminaire design* used for all louvered bottom tests.

Again, extensive photometric studies were necessary to determine the required physical characteristics of the plastic materials. Resulting photometric distributions are shown in Chart V. The downward component for both the 2- and 4-lamp units is relatively small. Here again, there is a mutual buildup of lamp brightness in the 4-lamp unit which makes it necessary to limit the downward component to 15 per cent of the total output. With the two-lamp unit, the downward component may be 24 per cent of the total output without exceeding the Standard Practice brightness limits. From a comparison with Charts III and IV, it appears that the coefficients of utilization of all three types of units are not too far apart.

The brightnesses shown in Chart V indicate that the luminaire brightnesses are well within the



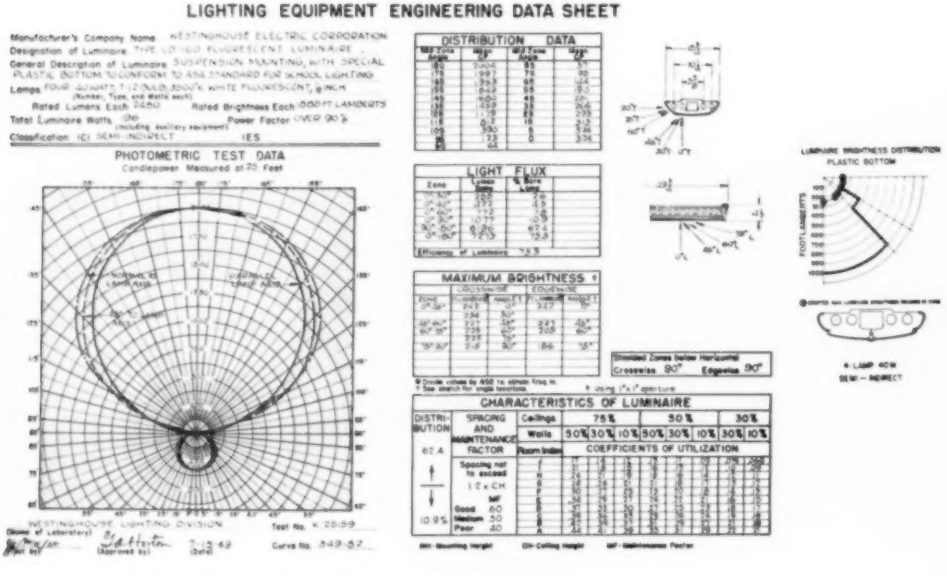


CHART V

Photometric Data

For typical 2- & 4-lamp 40W luminaires with translucent plastic bottom.

limits set by the Standard Practice for the Usual Visual Environment. The laboratory investigation revealed a fundamental design characteristic which indicates a weakness in the method of specifying brightness in tabular form. It was found that while the 0-45° zone brightness limit is shown as 1000 footlamberts, it was not possible to even approach this value and at the same time limit the brightness in the 60-90° zone to only 225 footlamberts.

The louvers used in the installation previously described were replaced by translucent plastic bottoms and the illumination and room brightness distribution shown in Fig. 5 obtained. Now, because of the high upward component there is virtually no reduction in illumination between rows. The measured initial average illumination level is 60 footcandles which is the same as that obtained with the 45° louver and 4 footcandles lower than the level with the X° louvers. The increased dirt collection in a closed bottom unit will, however, result in a greater difference between the maintained levels for three types — 36 footcandles for the plastic bottom, 42 footcandles for the 45° louver, and 45 footcandles for the X° louver.

The room brightness distribution shown in Fig. 5 indicates a major improvement in lighting quality over all of the previously described installations. As would be expected, the plastic bottom luminaire brightnesses are about ½ the brightnesses of luminaires with 45° or X° louvers. The appearance of this installation and the seeing comfort afforded received very high ratings by observers viewing the installation. Many school officials feel, however, that the advantage of increased comfort provided by such an installation is more than offset by its higher cost, lower illumination level, and a greatly increased maintenance problem. A closed bottom luminaire is particularly troublesome in school classrooms where children are prone to toss paper wads, clips, etc. into the luminaire. Louvered bottoms will normally allow such extraneous matter to fall through unless the louver cells are too small to permit passage.

Summary

To permit a more direct comparison of the various lighting systems under discussion, the most important data has been summarized in Table I. This table also includes comparative installation costs and annual lighting costs. Once more it is apparent that quality lighting can be obtained only by increased expenditure on the part of the user. Certainly a function of the lighting industry is to convince school officials and those charged with the specification of equipment for

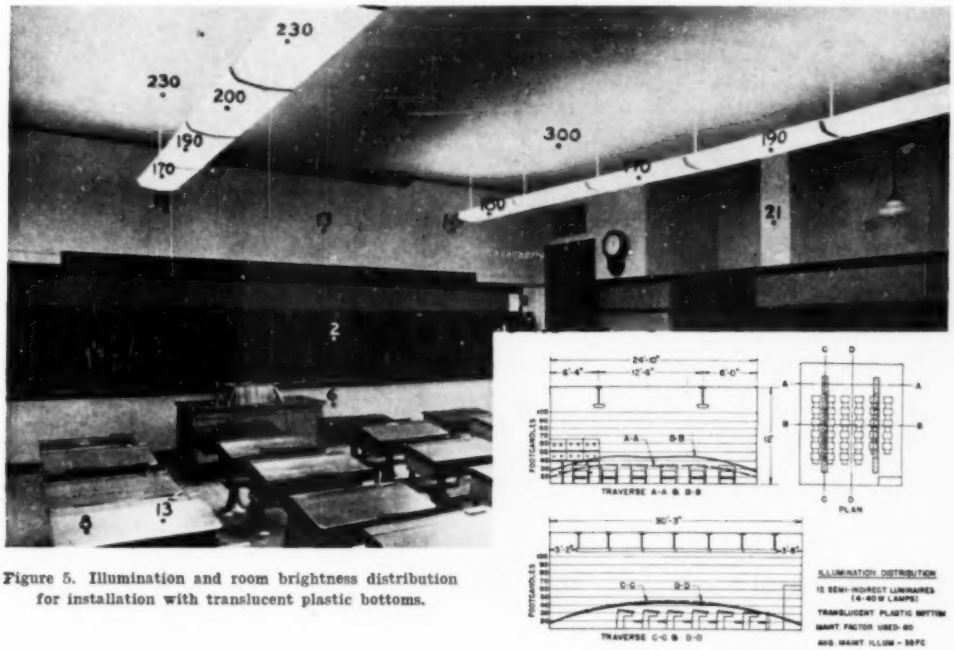


Figure 5. Illumination and room brightness distribution for installation with translucent plastic bottoms.

classroom lighting that the increased benefits of quality lighting justify its higher cost.

Conclusion

Any I.E.S. Committee that attempts to improve the quality of lighting installations by establishing standards for all to follow should be commended for its effort and intestinal fortitude. Any recommendation of brightness limitations for a given application is bound to be subject to controversy, since there is still much to be learned about the quantitative rating of glare and its effect upon vision. The data obtained by the extensive laboratory and field tests described in this paper indicate, however, that some modifications of the brightness limitations may be desirable for the following reasons:

1. The Standard Practice recommends brightness limits without specifying how these brightnesses are to be measured. Inquiries have shown that different testing agencies are not all using the same method or type of instruments for measuring brightness.

2. With any conventional louver designed to give a shielding angle of 45° or even more, the 0-45° brightness limit is always exceeded with a 4-lamp limit. If a ¼" x 4" test area is used for the brightness measurements, even the two-lamp luminaires exceed the brightness limits. It is believed that the Committee did not intend to rule out 4-lamp louvered luminaires when they prepared their recommendations nor did they intend to force the purchaser to spend as much as 32 per cent more per footcandle per year to use a two-lamp louvered unit. The desirability of three rows of two-lamp luminaires is generally recognized by the lighting industry. There is no denying, however, that such installations are considerably more expensive than two-row installations of four-lamp luminaires.

3. It is not clear what the Committee had in mind when they stated that "*approximately* double the values given (in Table IV) be accepted as the limits of brightness" where light finishes are employed.

4. Four-lamp louvered units designed specifically to meet the recommendations fail only in the 0-30° zone. It is believed that slightly higher brightnesses in this reflected glare zone will increase acceptance of the Standard Practice without affecting its intent, namely, to insure quality lighting in school classrooms.

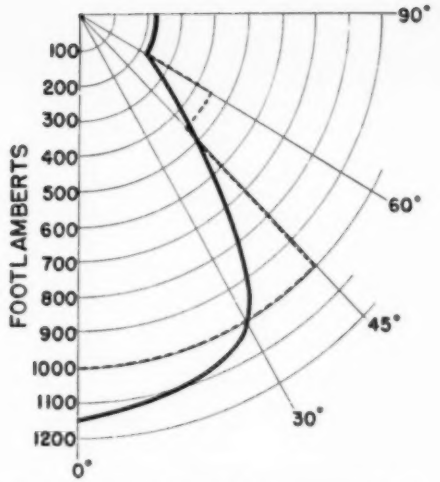
The above criticisms stem from the fact that insufficient allowance was made for increased rated lamp brightnesses and for the mutual build-up in brightness between adjacent lamps and reflecting surfaces and from the fact that no tolerances for either the angular zones or the brightness values were included in the brightness limitations. The absence of any tolerance or smooth transition between angular zones results in a ridiculous condition that permits 2000 footlamberts of brightness at 44° and limits the brightness to only 900 footlamberts at 46°.

To provide a smooth transition between angular zones it is suggested that brightness limits be specified by means of a curve such as shown in Chart VI. It should be noted that the limits in this curve have been increased somewhat in the

TABLE I.—Summary.

SHIELDING METHOD	LAMPS	EFFICIENCY	DISTRIBUTION	COEFF. OF UTIL. (STD. ROOM)	MAINT. FACTOR (GOOD)	MAINT. FC. PER UNIT *	WEIGHT OF LOUVER	SURFACE AREA OF LOUVER (sq in)	RELATIVE COST OF LOUVER	RELATIVE INSTALL. COST PER FC.	RELATIVE ANNUAL COST PER FC.	MEETS STD. PRACT.	MAXIMUM BRIGHTNESS (FOOTLAMBERTS) 0-45°	45°-60°	60°-90°
30°x 25° LOUVER	2-40W	82%	↑ 57% ↓ 43%	41	.70	2.0	3# 10oz	628	1.00	1.46 †	1.32 †	NO	1936 (30°C) 2000	1537 (45°E) 900	838 (60°E) 450
	4-40W	80%	↑ 59% ↓ 41%	41		4.0	6# 8oz	1129		1.00 †	1.00 †	NO	2221 (25°C) 2000	1717 (45°E) 900	749 (60°E) 450
45°x 45° LOUVER	2-40W	71%	↑ 70% ↓ 30%	.32	.70	1.5	10# 11oz	1852	5.00	2.53 ‡	2.20 ‡	YES	1799 (0°) 2000	373 (45°E) 900	230 (60°C) 450
	4-40W	68%	↑ 70% ↓ 30%	.31		3.0	15# 11oz	2722		1.77 †	1.64 †	?	2150 (0°) 2000	550 (45°E) 900	410 (60°E) 450
x° LOUVER	2-40W	74%	↑ 64% ↓ 36%	.35	.70	1.7	6# 4oz	1086	1.25	1.73 †	1.57 †	YES	1921 (30°C) 2000	900 (45°C) 900	217 (60°E) 450
	4-40W	75%	↑ 68% ↓ 32%	.36		3.5	10# 11oz	1852		1.16 †	1.19 †	?	2269 (0°) 2000	835 (45°C) 900	371 (60°C) 450
TRANSLUCENT PLASTIC	2-40W	73%	↑ 76% ↓ 24%	.30	.60	1.2	—	—	—	2.60 ‡	2.36 ‡	YES	240 (30°C) 1000	237 (45°C) 450	225 (60°C) 225
	4-40W	73%	↑ 85% ↓ 15%	.28		2.3	—	—	—	1.88 †	1.86 †	YES	242 (0°) 1000	227 (45°C) 450	225 (60°C) 225

* IN STD 24'x30'x12' CLASSROOM USING WHITE LAMPS AND GOOD MAINTENANCE FACTOR.
† BASED UPON 2 ROWS OF 6 UNITS EACH.
‡ BASED UPON 2 ROWS OF 7 UNITS EACH.
‖ BASED UPON 4 ROWS OF 7 UNITS EACH.
[ ] RECOMMENDED MAXIMUM.



VALUES SHOWN ARE FOR USUAL VISUAL ENVIRONMENT. FOR A CONTROLLED VISUAL ENVIRONMENT, ALL VALUES MAY BE DOUBLED. ALL LUMINAIRES WILL BE CONSIDERED AS COMPLYING WITH THE STANDARDS IF THEIR BRIGHTNESSES DO NOT EXCEED CURVE VALUES BY MORE THAN 10%.

CHART VI
Suggested method for showing maximum recommended brightness limits.

0-30° zone while all other limits approximate the originals recommended in the Standard Practice. A further 10 per cent tolerance has been suggested to absorb changes in lamp design etc.

Acknowledgments

The authors acknowledge indebtedness to Mr. Ralph P. Orchard, Superintendent of Building Maintenance, Lakewood Board of Education, for use of the standard classroom used in all field tests; to Mr. J. H. Burson of Westinghouse for his assistance in making field tests and compiling data; and to Messrs. George Horton, James Klyne, Bob Haynes, and Tom Humphreyville, of the Westinghouse Photometric Laboratory for their photometric test work and studies which made this paper possible.

References

1. American Standard Practice for School Lighting. Approved Sept. 20, 1948. American Standards Association, Inc., A.I.A. 31-F-28, A23.1-1948 UDC 628.9: 727.1.

2. The I.E.S. Guides to Testing Procedures prepared by the Committee on Testing Procedures for Illumination Characteristics.

DISCUSSION

R. L. Biesele, Jr.*: The excellent studies presented by the authors in this paper merit careful study by any designer of equipment or installations who is interested in the development of improved lighting techniques. As an example of the fund of information which has been presented, I should like to point out the brightness values shown on the lower left-hand desk in Figs. 1, 3, 4 and 5.

Lighting engineers have given little consideration in the past to the possible detrimental effects of specular reflection from the lighting system. The brightness readings on this desk show just how serious this effect can be.

In each case, the desk receives an illumination of approximately 50 footcandles. With a typical task of 70 per cent reflectance, the brightness of the task should therefore be 35 footlamberts. If the task has an assumed specular reflectance of one per cent, however, which is not uncommon in school tasks involving glossy paper or pencil marks, and a source of 2000 footlamberts brightness is reflected toward the observer by this glossy surface, then the brightness due to specular reflection is 20 footlamberts. This sheen of specular reflection would be sufficient to interfere materially with the visibility of the visual task.

That this condition can be expected with louvered bottom fluorescent equipment is substantiated by the readings shown on the desk in Figs. 1, 3, and 4, as compared with the readings of Fig. 5 for the plastic bottom unit. It has been my experience over a period of some years that the specular reflection from louvered-bottom fluorescent equipment can be a seriously disturbing aspect of the lighting system. Elimination of such specular reflection merits far more serious consideration than it has ever received from lighting engineers. In many cases, it may make the difference between an unsatisfactory and a satisfactory installation. The Society may be well advised to limit the brightness of lighting units in future Recommended Practices far more severely than it has done in the current American Standard Practice for School Lighting.

Phelps Meaker*: Making much the same compromises as those mentioned by the authors, I sketched up an imaginary two-lamp fixture which would have brightness limitations as imposed by the Standard Practice. A glare factor determination for a classroom employing such an empirical luminaire came out at a level which I interpreted as entirely consistent with the intent of the committee.

It interests me no end to examine the trend of activities in the evaluation of comfort. More and more, area and brightness are entering the picture. As luminaire dimensions fall into a more or less standardized pattern, the situation is approaching the point where a brightness specification practically becomes a specification of the shape and magnitude of the candlepower distribution curve in the lower hemisphere.

I hasten to defend the committee for establishing specification points which can be interpreted as absurd from the standpoint of practical luminaire construction.

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It is obvious that instructions to a measurements laboratory have to be specific and often arbitrary. Let us try to interpret the data in terms of the recognized intent of the sponsors.

RUSSELL C. PUTNAM:* The authors have written a timely and useful paper. It discusses a problem of current interest and presents data that illuminating engineers can study with profit.

Clarification and standardization of luminaire brightness measurements certainly are needed. At the time of writing the new American Standard Practice for School Lighting, the 1948 Guide for Photometric Testing of Fluorescent Luminaires had not been released. As the authors point out in this paper, the latter authorizes alternative methods of measurement of luminaire brightness which may give very different values, thus introducing considerable complication into the interpretation of the brightness limitations which had been set up previously by the American Standard Practice of School Lighting. Recent correspondence with the chairman of the committee which produced the American Standard Practice and with other members of the committee indicates that they had the one inch square test area in mind. Since the authors of this paper used the same method the comparison of their data with the recommendations of the American Standard Practice is logical.

In the preprinted paper the statement was made that the one inch by one inch test area was used for all brightness measurements described in the paper although a Luckiesh-Taylor brightness meter (which has an entirely different test area) was used to obtain the brightness measurements in Figs. 1, 3, 4 and 5. In the verbal presentation this statement was corrected to read that the one inch by one inch test area was used for all laboratory brightness measurements. However, since illuminating engineers ordinarily use a Luckiesh-Taylor brightness meter for field measurements, I would like to know how the authors correlated the two types of brightness readings which are based on entirely different test areas. References are made throughout the paper to the room brightness distributions (Luckiesh-Taylor test area) to substantiate arguments based on luminaire brightness distributions (one square inch test area) with the inference that they are equivalent.

The authors state in their synopsis that the new American Standard Practice for School Lighting establishes *two* important standards — minimum illumination levels and maximum permissible luminaire brightnesses. As a matter of record it gives *three* specific recommendations, the other (which is given first in the Standard Practice) being the recommendations for limits of brightness ratios in schoolrooms. Many engineers and educators consider this as the most important of the three and as some of these ratios are directly affected by the design and brightness pattern of the luminaire, it is regretted that this paper only considered two of the three correlated recommendations.

*Prof., Electrical Engineering, Case Institute of Technology, Cleveland, Ohio.

The economics of school lighting are such at present that the open bottom louvered fluorescent luminaire is widely used. It has been my observation with this type of luminaire that (a) a comparatively small change in louvering at the critical angles results in a decided change in visual comfort and (b) that the reflection characteristics of the room surfaces are especially important when such luminaires are used. The authors of the new American Recommended Practice for School Lighting had these in mind when they set up the brightness standards and required a controlled visual environment (Case II in this paper) before permitting sufficiently high brightness values to allow louvered luminaires to be used with standard 40-watt fluorescent lamps.

I question the economic comparison which the authors make regarding four-lamp luminaires in two rows versus two-lamp luminaires in three rows. It has been my observation that with the latter system in a standard classroom having unilateral daylighting two rows of the two-lamp luminaires, supplemented by daylight, is quite satisfactory for most of the time school is in session, the row nearest the windows being needed only when the daylight level is very low. In contrast both rows of the four-lamp luminaires are needed much of the time when that system is used in a similar room in order to give adequate light distribution in the center of the room. If the cost of energy is included in the economic comparison the two-row, four-lamp system may not have much economic advantage over the more desirable system of three rows of two-lamp luminaires.

We are indebted to the authors for their X° louver design which meets the luminaire brightness recommendations of the American Standard Practice (for the two-lamp luminaire) with relatively good efficiency, economy and light distribution. It is regretted, however, that installation data are limited to the four-lamp luminaire and are not given for the two-lamp luminaire in view of the interest now shown in that type of luminaire.

I believe that the authors are unduly pessimistic concerning the evaluation which educators place on visual comfort as compared with lighting levels. My experience indicates that an increasingly large number of school executives are placing a high value on seeing comfort and are becoming convinced that the benefits of high quality seeing conditions more than justify any increased cost. Educators are showing a willingness to follow our recommendations in regard to room finishes, chalkboards, etc., and I am confident that they will be willing also to install high quality lighting as they come to appreciate the importance of an integrated visual environment.

LEONARD V. JAMES:* The contents of this paper have been ably presented by the authors and well discussed by Professors Putnam and Biesele. As chairman of the Committee on School Lighting which prepared the 1948 revision of the American Standard Practice for School Lighting, I would like to add a brief explanation of the attitude and intentions of that committee with reference to the matters under discussion. Incidentally, the Stand-

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ard was approved by Council for submittal to the American Standards Association in April of 1947 and all committee action naturally preceded that date — over two years ago.

The general matter of limiting luminaire brightnesses was one in connection with which little authoritative assistance was available. The committee on luminaire performance could give us no suggestions. Other committee reports revealed nothing of importance to help. Some members definitely favored dodging the issue by omitting all numerical reference to it.

But this was not a matter to be dodged in a treatise intended to be a practical guide to engineers and others seeking to establish satisfactory visual conditions in the school. Frankly, it was decided to meet the issue in a practical way by making possible the approval of acceptable existing luminaires, from the standpoint of brightness, and, when such limitations had been approved by Council and its advisers, by the A.I.A. and by A.S.A. and its sectional committee, letting this guide us until more precise values could be determined.

The customary zones of regard were recognized as exposure to the work (0°-45° from nadir), exposure within 30° from the normal horizontal line of vision (60°-90° from nadir at the luminaire) and the zone between these two as within the field of vision but not within the 30° angle (45°-60°). For these zones, the values of limiting brightness in footlamberts shown by the authors in the quoted Table IV and in Case I Chart I were specified. In particular, it was agreed that the usual fluorescent lamps would not be acceptable in louver bottom luminaires except in rooms having footcandle levels and brightness ratios conforming substantially to the requirements of Tables I and II of the Standard Practice, while such low brightness lamps as the 40-watt T17 would be permissible.

At the time this work was done, the standard procedure for measuring luminaire brightness was understood to be through the determination of the average brightness of the inch square (projected) having the maximum such average brightness, when observed from the angle under consideration, and this method was contemplated by the committee.

It should be recognized that the maximum brightness values given might be at any angle within those specified in the table. The "ridiculous condition" referred to in the conclusion in this paper need not apply unless the designer wishes to attempt to perform the ridiculous feat of extending the brightnesses of his luminaire to the maximum permissible at all angles.

In Conclusion No. 3 the authors comment on the use of the word "approximately" by the committee in prescribing the maximum brightness in a room where the visual environment is well controlled. Again let it be stated frankly that the school lighting committee which used this expression did so deliberately. When the research committees of the society definitely establish precise specifications of brightnesses for various possible environmental conditions, it will be time enough for an application committee to prescribe them more precisely than was done. Until then, the committee felt that the values in its Table IV should apply, except that somewhat higher values of the order of double those in the table might be permitted under favorable conditions.

R. W. Wilson:* In discussing brightness patterns along with light distribution, it has occurred to me on several occasions that a considerably better effect could be obtained in both cases if closer attention were paid to the mounting of fixtures.

In many installations fixtures are hung on suspension hangers because conditions suggest that method with the result that we produce a rather objectionable appearance. Two continuous rows of fluorescent fixtures with two or three hangers per fixture in a room 20 by 40 feet would mean a total of 36 hangers in this room. All this "pipe" is very unsightly, and because of this fact, fixtures are usually moved clear to the ceiling.

This removes the objectionable appearance of the hangers, but presents another problem. When fluorescent fixtures are mounted directly on the ceiling, we find a band of brightness around the edge of the fixture from eight to twelve or fourteen inches wide, depending on the depth and construction of the fixture. This, then, presents extremely bright "spots" around the fixture with corresponding dark areas between the fixtures or rows of fixtures.

By suspending the fixture 10 to 12 inches from the ceiling, we broaden the area of brightness and practically eliminate the dark area with the result that we produce fairly even brightness on the ceiling with a resulting improved distribution. Hangers of this length are hardly visible so there is no objection to unsightly hangers.

Some manufacturers quote 10- or 12-inch hangers as standard. Others will provide these short hangers at additional cost. On other occasions the 36-inch hangers are "cut down" on the job because the customer prefers a certain fixture but the short hangers are not available from the manufacturers except at increased cost.

It would be helpful and practical from a cost standpoint if all manufacturers would include 12-inch hangers as standard with other lengths in their line, and would simplify recommendations and improve installation problems and appearance.

F. C. Winkler and J. J. Neidhart:** It was hoped that this paper would provoke some lively discussion, and the authors are grateful to Prof. Putnam, Prof. Biesele, Mr. James, Mr. Meaker, and Mr. Wilson for their response. Their comments are a welcome contribution to the lighting knowledge on a subject that is arousing considerable public interest today.

Prof. Putnam's disclosure that a one inch square test area was intended for the brightness measurements is a vital bit of information that should be highly publicized and written into the Standard Practice for School Lighting as soon as possible. An even better and prob-

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ably easier solution would be a revision of the Testing Procedure to eliminate the vague instructions for making brightness measurements. Standards are worthless unless they are based upon specific test procedures that all must follow.

We thank Prof. Putnam for calling attention to our oversight in stating that all brightness measurements were made with a one inch square test area. The Luckiesh-Taylor brightness meter is much more practical for making field measurements. In showing the room brightnesses, we did not intend to infer any correlation between the luminaire brightnesses measured in the laboratory and in the field. Field data should never be used as a check on compliance with the Table IV brightness limitations of the Standard Practice. The field data were included in the paper as a matter of interest and to show the effect of the different types of shielding upon the brightnesses of the room surfaces and the brightness ratios. We were thinking of the brightness ratio standards which we neglected to mention in the synopsis, but we did not wish to delve into this subject too deeply. This is another phase of the Standard Practice which merits a separate and more comprehensive investigation. We hope to make such an investigation in the ensuing months.

If space permitted, we could show data to prove our economic comparisons showing the advantages of four-lamp luminaires. We do wish to call attention to the relative cost figures in Table I. It should be noted that these figures were based upon a comparison of *two*-row installations of both two- and four-lamp units. Also, the relative annual cost per footcandle figure does include energy and maintenance cost. We also have measured illumination data showing that the inner row only of a two-row, four-lamp installation combined with the shaded daylight provided on a bright day produces a very satisfactory distribution across the room with over 30 footcandles on all desks.

Although the installation data reported in the paper is limited to four-lamp luminaires, it is essentially applicable to two-row installations of two-lamp luminaires. The primary reason for obtaining the installation data was to ascertain whether a two-row installation would provide a satisfactory distribution across the room when the luminaires were more tightly shielded. There was never any question that the distribution from a three-row installation would be satisfactory.

Our pessimism concerning the evaluation that educators place upon visual comfort is based upon our experience. We agree that many school executives are convinced that high quality lighting is worth the extra cost, but we find that many of these people lack the economic means to carry out their convictions. This is particularly true in industrial cities where atmospheric pollution has been a dominant factor leading to the popularity of louvered bottom equipment.

Prof. Biesele has called attention to a condition in our test room which was beyond our control and which had no significant effect upon our test data or the conclusions which were drawn from the data. The room admittedly does not comply with the Standard Practice requirements permitting the use of louvered bottom equipment. The furniture finishes are particularly bad, and the reflected brightness data to which Prof. Biesele refers bears out the validity of the Committee's requirement for a controlled visual environment if louvered equipment is to be used.

Mr. James, we are well aware of the lack of authoritative data available at the time your committee prepared its recommendations. The American Standard Practice of School Lighting which was prepared under your guidance is an excellent guide, and we are giving it our full support. You say that your committee set the recommended limitations under discussion as a temporary expedient until more precise values could be obtained. We hope that the data reported in our paper will lead the committee to reconsider their recommendations and recommend changes to overcome the objectionable features mentioned in our paper. We know of at least one laboratory that is not using and never has used a one inch square for brightness measurements, but unsuspecting users still try to compare this laboratory's data with that of other laboratories using a one inch square. Furthermore, we still maintain that the use of the word "approximately" seriously weakens any standard in that it permits unscrupulous interpretations indicating compliance with the Standard Practice when brightnesses actually exceed recommended limitations by a considerable amount. The scrupulous manufacturer who refuses to take advantage of the loose interpretation is thereby placed at a disadvantage by admitting that his luminaire does not comply.

Mr. Meaker has made a very significant statement that should be of interest to all committees concerned with the establishment of recommendations that will ensure visual comfort in a given application. He points out that the trend is toward a fairly constant luminaire size so that area may be neglected in determining glare ratings. Such an assumption seems to have been made by the School Lighting Committee, but we wonder what the comparable brightness limitations would be for the smaller area incandescent luminaires shown as being suitable for school classroom lighting.

In reply to Mr. Wilson's suggestion that shorter suspension hangers are desirable, we call attention to the appearance of the installation shown in Figs 1, 3, 4, and 5. These luminaires are suspended on *standard length* hangers providing an overall suspension length of 27 inches. We believe that the appearance of this installation is very good and that the 10:1 ratio of ceiling brightnesses would be materially increased by employing shorter suspension lengths. It should also be noted that there is only one more hanger than the number of units in the row — not two or three hangers per luminaire. The importance of adequate suspension length is emphasized by the fact that even louvered bottom luminaires may be semi-indirect when tightly shielded to conform with the Standard Practice limitations.

Brightnesses in Visual Field at Borderline Between Comfort and Discomfort (BCD)

By Matthew Luckiesh and S. K. Guth

DISCUSSION

A. A. Brainerd*: Lighting development and lighting measurement go hand in hand. With the appearance of various measuring instruments such as the Sharp-Millar photometer, the Macbeth Illuminometer, the photo-cell photometer, brightness meters, visibility meters, recording spectrophometer, etc., we were able to push back the frontiers of our knowledge of light and seeing. If we had a portable, accurate direct reading instrument to measure glare, our knowledge of light and seeing could be expanded with much greater speed.

The paper by Dr. Luckiesh and Mr. Guth is one more step in removing the mystery surrounding glare. A measurable relation between light source and surround brightness for comfortable seeing has been established. In studying the details I note that the subject was exposed to the conditions under test for one-second intervals. Assuming that time is an important factor, I would like to ask the authors how such a short period of time (one second) was measured and also what the probable error in measurement would be. I would also like to know the method by which the subject impressions were recorded.

In selecting the 50 subjects was a record made of the condition of the eyes and whether or not glasses were used? It would seem that the presence of glasses might affect the results of the tests on position of the light source in the visual field.

Matthew Luckiesh and S. K. Guth**: Mr. Brainerd asked some questions about certain experimental details and procedures. Short time-intervals can be produced with a high degree of precision in a number of different ways. A convenient one, which we used, involved an accurate commutator attached to a constant-speed electric motor. The probable error in producing our time-intervals is insignificant.

Each subject adjusted the brightness of the comparison-source so that the sensation received from it appeared to be at the borderline between comfort and discomfort. This was the BCD brightness for the particular subject and experimental condition; and was recorded as a measure of his subjective evaluation of a specific combination of conditions. It is emphasized that the subject was free to establish his own criterion of BCD sensation. This is covered in considerable detail in the section of our paper which deals with the experimental criterion, environment and procedures.

All of the subjects used in this investigation possessed so-called normal vision. Three of the final "representative group" of 10 subjects normally wore glasses. However, the amount of required correction was small and there was no significant impairment of vision if the glasses were removed. Since critical seeing of fine details was not involved in these investigations, the glasses were not worn during the tests involving the variation of position of the source in the visual field. Tests with and without glasses indicated identical results.

In describing the procedures and results of an extensive investigation of this character, the authors are always confronted with space limitations. We hope that we have treated the important aspects sufficiently for most persons, but we will be glad to discuss any aspects of our procedures and results with anyone who is interested in more details.

*Philadelphia Electric Co., Philadelphia, Pa.

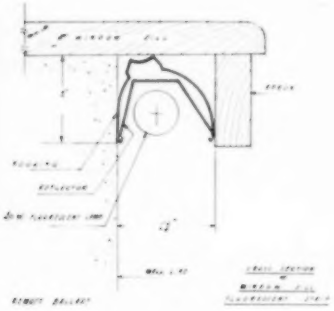
**Authors.

Illuminated escalators are a feature of the new Bloomingdale department store at Flushing, L. I. Behind tempered glass lining the inner side of the stairway balustrades, T-6 slimline fluorescent lamps create a cool, shadowless "wall of light." Photo courtesy Westinghouse Electric Corp., Pittsburgh, Pa.

Lighting of a Hallway

LIGHTING OBJECTIVE: To provide useful illumination for safe seeing conditions, and to create a striking decorative effect enhancing architectural details and home furnishings.

Installation in the residence of
Mr. Jacques Makowsky, Great Neck, N. Y.
Architect: Edward D. Stone
Lighting Consultant: Thomas Smith Kelly



General Information: This hallway is approximately 15 feet long and 9 feet wide. It connects the entrance foyer with the living room which is at a level three steps lower than the front doorway. The ceiling is light cream with 80 per cent reflection factor; the walls are light beige with 75 per cent reflection factor; the carpet is medium beige with 35 per cent reflection factor; the floor is dark red glazed brick with 8 per cent reflection factor. The davenport is rose-beige and the end tables are blond mahogany. Large plate glass windows run the entire length of the hall giving a view of Long Island Sound which is picturesque both by day and night. The artificial lighting had to be so installed as not to interrupt the night view.

Installation: Five 30-watt soft-white fluorescent lamps were mounted in a continuous row under the window sill in a continuous run of Alzac reflector. Reflector and lamps are concealed by a wooden apron two inches deep. The ballasts are located in the basement. There is an average of 10 to 15 footcandles on the floor and no interference with the night view through the windows.

The lighting strip was designed by Thomas Smith Kelly, New York City and manufactured by the Klemm Reflector Company, Philadelphia, Pa. The woodwork was designed by Murphy-Brinkworth, New York City.

Lighting data submitted by Thomas Smith Kelly, Lighting Consultant, New York City, as an illustration of good lighting practice and to aid in the design of similar installations.

Lighting data assembled by Subcommittee on Home Lighting Data Sheets and published by the Committee on Publications of the Illuminating Engineering Society, 51 Madison Avenue, New York 10, New York.

A.I.A. File No. 31/12

Color and Light in the Home

By GLADYS MILLER
JAN REYNOLDS

SHOULD THE many problems of small home design for the average family be solved during the Twentieth Century, the questioning people of our time will have earned an unsung reward.

The subject is complex. It includes suitable building materials and their economical distribution, efficient and understanding use of skilled and unskilled labor; better design to include adequate space for living, sleeping, eating, food preparation, and current and seasonal storage. The small home embraces an environment for rest, work, play and companionship that is healthy and vigorous, not stilted, monotonous, or drab.

Among the problems is the effective and valid use of light and color in the small home. Many people have studied light, many have studied color, and some are now studying the relationship of light and color to each other. These two factors are closely related to space, to exposure, to physical needs, and to the emotional preferences and prejudices of individuals and groups.

How and where color and light are used, the amount of each in a given space, the relationship of the color and light to the texture of the material, the design, the quality of the colors and of the light, and their balance and distribution in an area — must all be considered. The successful performance of color and light in a room should not be obvious. It should be pleasantly accepted without the mechanical operation being evident.

The conditions created and given us by nature have been the criteria by which most of us have lived for years, consciously or subconsciously. This holds true particularly when it comes to the selection and interrelation of the use of colors. The various shades and tints of the clear sky give the impression of coolness and serenity, as do the greenness of foliage and the blue-green shades of water. That these colors recede, optically, is evidenced by and associated with the vast amount of space nature gives them. On the other hand, there are only hints of the more "dramatic" and exciting colors such as red, orange and yellow which are found in sunsets or the hot red blaze of fire. These colors are usually found only as "accents" in nature, and people today usually employ the vibrant shades of red, orange, or even yellow as definite accents for a room in which a great deal of time is to be spent.

These people, like Nature herself, feel the need for change. Nature accomplishes this with the four seasons — winter, spring, summer and fall — not only with a change in temperature, but in the change in the living things around her. From the cold grey-whiteness of winter into the fresh cool greenness of spring, moving quickly into the warm and then hot sensation of the summer sun and sand, Nature changes finally into the beauty and warmth of the browns, burnt oranges and tans of the changing leaves, completing the cycle only too soon with winter snow and grey winter skies. People, on the other hand, accomplish these changes a bit differently. The woman or man from the warm or even hot climates may dress in warm orange, red or warm tone colors, but very often they turn toward the cooler shades of blues and greens in home decoration, with only a few accents of red or orange. Contrarily, the northerner who is accustomed to heavier, bleaker and colder skies, finds herself, perhaps, more interested in "warming up" the residential interior with large areas of warm beige or rose, with accents of bright greens or blues.

The Psychology of Color Preferences

Thus there are psychological motives as well as practical ones which influence the lives of individuals. People who have spent a greater portion of the day, for example, in the hot sunny oil fields of Texas, feel more relaxed and content in a home that has a cool, restful atmosphere. An office worker, bustling in and out among the hubbub and noise, also craves the quiet and peaceful air of a comfortable home. On the other hand, the nurse or doctor who may have experienced a busy day within the white, sterile rooms and corridors of a hospital, would welcome a warm, cheery atmosphere to dispel the feeling of anesthetic monotony. Few individuals will tolerate for long the tension and boredom of monotony. They want to reduce this sameness surrounding them. They want a change of pace. We introduce color into interior areas with paint, pigment, dye or with materials colored by nature.

Color and Its Relation to Light

To the degree that these man-made or natural colors are lighted depends our ability to see and

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appreciate each color. Most everyone knows that our eyes function much like the camera, with light radiation passing through the lens to be focused on the retina with its rods and cones at the back of the eye. These rods and cones absorb the energy, and by photo-electrical and chemo-electrical processes, pass this impulse along the optic nerve to the brain. There is a reason for both these rods and cones. The former perform only under lower levels of ilumination, differentiating between the grey, white and black shades, with little or no detail discrimination. The cones enable us to distinguish color, and permit us to see acute detail. These cones perform under high-level illumination.

While the visible spectrum contains blue, green, yellow, orange and red, it is believed that the cones perceive only red, blue and yellow. The first colors to fade from view as the light is diminished are at the violet end of the spectrum, while the yellow-greens remain visible longer because of the eye's sensitivity to the 5550 Angstrom wavelength radiations.

While there are numerous theories as to why people see color, the Young-Helmholtz theory is perhaps most widely accepted. This theory contends that the eye responds in three different ways to color, and is stimulated by sensations of red, green and violet. Thus combinations of these three colors of light will permit other color sensations.

To further understand color and its relation to light, it may be in order to define some of the terms most frequently used in such discussions. The most common visible characteristics of color as applied commercially are hue, chroma, value and finish.

Hue, designates the color itself, whether it is blue, green, red, etc. A light blue and a dark blue are the same hue.

Chroma, refers to the intensity of a color, as it advances from a grey to its greatest saturation.

Value, is the tonal quality of a color. When it is dark in value it is called a shade, and becomes a tint if it is light in value.

Finish, refers to the surface reflecting or radiating quality of the color. In other words, color appearance depends to some extent upon whether the surface is smooth, rough or glazed.

We have the natural light of both the day, and the night — light by the sun and the moon. We have the even light from the north and the more uneven light from the south, east and west. And now invention has given us many forms of artificial light. Great progress has been made in developing this new means of light for commercial and industrial purposes. Lately, color has become recognized as an important factor, for with light it can lessen fatigue, increase efficiency, and prevent accidents.

Much of the research material can be applied to the home if those specifically interested, such as the architect, contractor, builder, interior decorator, designer, lighting specialist, and home owner, will analyze the findings from opposing points of view and pool the results. These results must be resolved into the economic picture within the framework of known home requirements, materials, and installation costs. The impact of many influences such as these is slowly and surely changing our concept of the human needs within the home and the design of the home to meet these needs.

New Trends in Design

No longer do we think of a house in terms of room patterns. The living room, dining room, bedroom are fast becoming obsolete. We think of areas, and in allocating functions to these areas we analyze the habits of the individual members of the family.

The home we now visualize is designed to give each member individuallly or group-wise the four things psychologists know we need if we are to develop into normal, healthy people, *i.e.*, security, self-expression, satisfaction and socialization. Fewer large homes are designed for the wealthy to dramatize their wealth. They give vent to their self-expression and obtain satisfaction by having smaller homes in different sections of the country to which they may fly. One may be a hunting lodge in the north woods, or a weekend place in the desert, or a home in the warm and sunny south.

For the middle and low income groups more units are being built. To meet rising material and labor costs, the size of the average is constantly decreasing. In twenty years the average $10,000 home has decreased from 2000 square feet to 900. (Fig. 1)*

Space in the home and its maximum and flexible utilization has become the challenging problem for all experts to study and solve. Color and light properly used help give the illusion of space.

The one living room is being replaced by two rooms, one for quiet activities and one for noisy ones. The kitchen is enlarged to incorporate dining activities. Children are provided individual dressing and study rooms, and all may sleep on a porch. Homes are being designed in the true sense of the word to meet the needs of each family.

While the new pattern evolves, the old pattern must be realigned to meet changing tastes. Large homes are remodeled to care for more than one

*See page 151 of the article "Houses— Much More Time and Study Must Be Devoted to the Thermal, Luminous, and Sonic Aspects of Their Design," by Kenneth Welch. *Architectural Forum*, November, 1948.

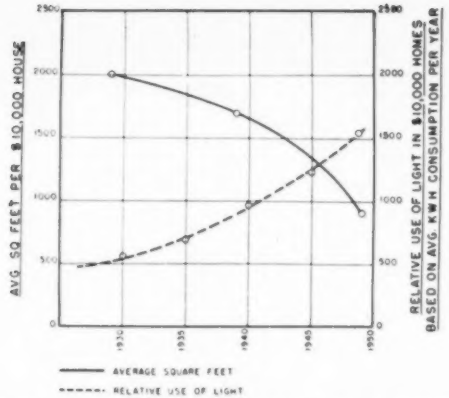

Figure 1. Chart showing average square feet in $10,000 house from 1929 to 1949, and average current consumption in homes during the same period.

family. Smaller homes are opened up and repartitioned. And with the old and the new the appropriate use of color and light in the small home becomes also a space problem.

Compared with the past, the existing home with its portable lamp, its center or side lighting fixture, its room switch to control light is better and more conveniently lighted than any in history. But this record is poor considering the known facts that, if properly applied, could make our homes more efficient and more attractive. The fact that one of every five school children has defective eyesight also indicates, to some degree, that our homes are inadequately equipped for health.

Unfortunately, few homes utilize color and light correctly by the known standards because the cost is often considered relatively out of proportion. A constant educational campaign must be waged to encourage acceptance of the new by workmen in each specialized field and by those who live in homes. We know how to equip lamps to give good light for special tasks. We must convince the average homemaker that better light is well worth its cost.

We know how to paint walls different colors to take advantage of the difference in reflecting and absorbing factors, but few painters are sympathetic to such procedure. It takes more time and thought, and consequently the cost is greater. We know how to coordinate pleasing colors in an area, but few families can afford to purchase all the furnishings of a room at one time, and rooms are generally in some partial stage of evolution that is incomplete and unhappy. Our financial experts may help solve this problem.

While we are working to reduce costs on suitable installations which we know will benefit a home, while we work to create understanding on the part of all concerned with the building and furnishing of a home at reasonable cost, constant research must continue.

Using Color Harmoniously

To be attractive, the colors in an area must harmonize and function as intended twenty-four hours of the day. We must know more about the effect of light, natural or artificial, not only on colors, but on colors distributed in different areas of the room and in varying quantities. We must know more about the physical and emotional effect of color on individuals and groups.

It is difficult, in this stage of development, not to use color and light badly at times. Often something new becomes popular before all factors contributing to its successful use are known, or before all people using the material have learned how to use it properly.

If light comes from only one direction, it is apt to be hard and unpleasant, unless softened by cross light. So the windows in a home are an important factor in selecting the color. As the cost of glass has decreased, as the benefits of sunlight have become recognized, the window and its placement and size have become important. Interest in solar heating has encouraged a new concept of the window wall, with versions of the glass house as a part of our future. The larger the window the longer more light will enter the room. A large window can be used even though there is no compensating view, where it aids in adding to the illusion of space by uniting the outside and inside.

For concentrated work, windows which give even north light are best. Windows on a south wall provide more sunlight, and windows on the east morning light. The least important light is from the west, and this is the best place in the room for the enclosed wall. If the windows are perfectly placed for light and air and their size is related to the room, it is relatively easy to retain the same color effect at night by adding valance lighting or having simple reflectors placed at each corner to divert reflected light from the roller shades into the room.

Natural light from windows strikes each wall at a different angle, causing the wall color to appear lighter, darker, greyed, or pure, depending on the amount of direct light the area receives and the quality of the color on the wall. The size of the room, the height of the ceiling, the shape of the room, its basic proportions, as well as the placement of windows and doors, affect the choice of color and

light for each area in the room. The ceiling represents the largest unbroken area and the walls the largest broken area in a room.

Not only can we use color in some form on the ceiling, walls, and floor, but we can break up the wall area at windows and doors by using contrasting instead of like colors. We place on the floor and against the walls, floor covering, furniture, and decorative accessories which not only have color but form, texture, line, design, and pattern. Each of these factors influences the effect that light has on color, and color on light.

As rooms become smaller, ceilings become lower. As we learn how to furnish with color and light, the ceiling has regained its position of decorative importance to the room. Artificial light reflected from white ceilings tends to draw color from floor covering and upholstery fabrics. In a room with a gold rug, reflected light from a filament lamp will make the rug a dirty tan color. Paint the ceiling yellow and the color of the rug is retained. Or you may achieve the same result by using little reflected light and more direct light. A low ceiling can appear even lower if there is too marked a color contrast between it and the side walls.

Bathrooms partially tiled with white or a light reflecting pastel appear much better proportioned if the walls and the ceiling above the tiles are painted the same color, and need not be the tile color. Occasionally, in small homes bathrooms are not provided with heating equipment, and in such instances a warm color for walls and ceiling will be better than a cool color, as this will compensate, psychologically, for the cool surface of the tile and porcelain equipment. Generally bathroom illumination and special shaving or make-up equipment should have the required footcandles for the task and the correct lamp to maintain the warmth and tone desired.

Walls and woodwork may be painted to match, harmonize, or contrast. Although a home may be small, we do not want it to *appear* small. To provide the maximum sense of space, walls and woodwork should be painted the same color, a light color and cool color. To take away the boxlike quality of a square room or a badly proportioned rectangular room, it is well to treat each wall differently. As we move further from the source of light, we can lighten the walls. In extreme instances, the wall farthest from the window will be a clear white. On one wall that is continuous with a wall into another room area, one color may be used to carry the eye and give an illusion of space. All walls do not need to be the same material. One can be brick, one natural wood, one painted, and one papered,

Figure 2. Dark colors against light backgrounds.

but all will have color, and because each wall color is different in value and texture, each wall needs specific lighting treatment. We achieve contrasts by placing dark against light or vice versa. Dark furniture against light walls has been the accepted furnishing pattern for many years. When bleached furniture, light floor covering and fixtures made possible by new finishes became popular, the reverse order took place (Figs. 2 and 3). This growing use of dark walls has been accepted by the public in spite of opposing viewpoints. It proves the cyclic need for change which is the basis for all Fashion, that much maligned and essential lady in our commercial pattern.

Figure 3. Light colors against dark backgrounds.

By dark is meant color with from two to sixteen per cent reflectance factor. To sensitive people, dark contrasts against light backgrounds are less fatiguing than light against dark, if there is the same balanced arrangement and harmony of color. But the more phlegmatic type needs the extra sensitory stimulation.

Dark walls make a room more intimate. All the dark walls of our time tend to be more formal than informal. Except when a desk is backed directly up to a wall, the wall facing the desk should be in a subdued color, even though other walls in the room are somewhat lighter. An arrangement such as this will tend to rest the eyes of a person working at the desk. Of course, severe contrasts should be avoided. Dark walls are excellent in bedrooms for those who have insomnia or are sensitive to early morning light. In a country home they can provide considerable relief for anyone who spends hours out-of-doors and needs the relief from brilliant natural light. A dark wall tends to be more mysterious and romantic than a light wall. That is why cocktail lounges are usually decorated with dark walls and lighted with soft lights. Each group in the room feels personally enclosed by the shadows.

When given complete freedom, a designer or decorator may use dark walls where natural shadows fall, and if a higher degree of light reflectance is needed will use a light color on a section of the wall, floor, or ceiling where necessary, and then duplicate the effect achieved by placing the correct artificial light to function similarly.

The dark wall or the contrasting wall, from the decorative point of view, prevents monotony and dramatizes and calls attention to light colors in the room. It may change the apparent shape of the room, making it more interesting. It is a decorating tool the only cost of which is knowledge of how to use it well. The decorative scheme will indicate whether the dark colors should be in a glossy or dull finish, smooth or rough texture, and of low or high intensity.

Accent colors are used in lamp shades, pictures, and decorative accessories to carry the eye in a rhythmic pattern from one focal point to another. The smaller the room, the fewer focal points there should be and the less contrasting the accent colors used. But some contrast is essential to avoid monotony.

The obvious should be avoided in the use of colored accents, as should the use of bright colors when they tend to break up relatively large planes that are needed to provide a sense of space and order. All accents need not be the same color, or the same value of a color. All good artists have learned and apply their knowledge of the difference between construction and composition. Thus some knowledge is essential in the correct application of light and color.

Portable Lamps

Dark, richly-colored opaque lamp shades have been accepted by the decorator and avoided by the lighting engineer. The former has a tendency to underlight a room, seeing it in use by day and by night. The latter is less interested in the appearance of a room and is absorbed with the problem of providing adequate illumination for seeing needs.

A room decorated with dark walls requires more artificial light to compensate for the wall absorption. Dark lamp shades absorb more light, although an open shade lined with white or shell pink can throw light up and down, and being opaque will show no hot spots or glare. A bland, even brightness pattern throughout a room, such as sometimes results with translucent lamp shades, can be even more annoying or less attractive than the contrast of opaque shades with lighted areas.

Lamp shades have two decorative uses in a room — one to shade the lamp and direct light where it is needed, and one to please the eye when the lamp is not lighted. Dark and colorful lamp shades improperly selected can spoil the color harmony of the room, and also absorb light needed for room illumination. Not only is the color of the lamp shade important, but its placement and the relationship of its color to other room colors, as well as its contribution to the overall lighting scheme must be considered. Some lamp shades may be neutral or possibly the color of the wall. Others should contrast and draw attention to the section in which they are placed. Because many of the materials used for white or light lamp shades result in too much brightness, decorators prefer more opaque materials and more lamps.

There are limits to the capacity of a given room to hold color, light, or design. As our standards for better light have been raised, it becomes more difficult to light a room adequately with portable lamps without the number of lamps becoming obvious and distracting.

Architectural Lighting

The time has come for a greater acceptance and use of cove, spot, niche, valance and cornice lighting. Center fixtures are not as adaptable with the lower ceilings of modern homes.

Decorators have not used this type of lighting as

much as they could for several reasons. First, because they did not understand it, they had difficulty finding workmen sympathetic with their point of view to install it, and it was difficult to convince clients that the advantages were worth the time and cost. The decorator has felt that a room loses much of its charm and mystery when there is more light than needed. To sense fully and to appreciate the colors in a room, there should be some shadows —some grey tones.

Light Sources

Just as the lighting engineer and specialist need to know more about the use of color in a room, the decorator needs to know more about simple lighting installations within the financial probabilities of home ownership. And both need to know more about the effects of filament and fluorescent lamps on individual colors and color combinations.

The incandescent filament lamp is the most familiar light source, and has been used more widely than the fluorescent lamp in the home. In the past few years the fluorescent lamp has become an increasingly popular source of illumination, particularly for built-in types of lighting.

As far as the standard filament lamps are concerned, their color temperature varies within a relatively narrow range of from 2400K to 3000K, except for the daylight bulb. Lighting of the incandescent type will be predominantly orange in character and consequently will emphasize any color that has large amounts of orange or yellow reds in its make-up.

Fluorescent lamps, on the other hand, are arc lamps containing argon gas and/or other gas and mercury vapor, and they depend upon their phosphor coatings to produce a wide range of "white" colors.

The introduction of the daylight fluorescent lamp over ten years ago and the subsequent additional four other "white" lamps was not intended to confuse the users of fluorescent sources, but rather to contribute to the art of illumination, by affording a variety of colors with which to work. In residential lighting this means a color for almost any situation that might arise to the home owners, decorator, or architect.

The warmtone, warmtint, or warm white lamps have a color temperature of around 3000° Kelvin. This particular lamp most closely approximates the standard incandescent lamp in color tone, and has as high an efficiency as any of the existing fluorescent sources.

The 3500K or standard white lamp, one of the most commonly used fluorescent lamps, is yellowish in color tone. It is considered quite comparable to the average color of natural light on a sunny day.

The 4500K lamp is nearest to a pure white color, because of its use of blue and green components in the phosphor blendings. The daylight or 6500K lamp is the bluest white lamp, and it approximates the color cast on an overcast day, but contains considerably less of the yellow or red of the standard white lamp.

Color Temperatures of Light Sources

The color of a light source is compared with the color of the light produced when a theoretical *black body* is heated. This *black body*, as it is generally accepted, has the ideal qualifications for emitting all the colors of the visible spectrum, from red through violet as it becomes hotter. Consequently, a light source is said to have a particular color temperature when its color is identical with that of the *black body* at a given temperature. Degrees Kelvin is the measurement scale used, which has a zero at —459.4° Fahrenheit. Theoretically, there is *no* heat at this temperature. Fluorescent light sources are designated, wherever possible, by color temperature in degrees Kelvin, such as the 4500K lamp is closest to the color the *black body* would be if heated to that temperature.

The soft white lamp has no color temperature designation because it produces a relatively large percentage of blue and red radiation, and the light from the *black body* cannot be made to approximate this very closely at any temperature because blue and red are at opposite ends of the visible spectrum.

A room may be decorated beautifully with colors that harmonize and please. But when the lights are turned on, the room may look drab and uninteresting. The decorator has neglected to become well formed on an important phase of his work, and is proved inadequate in his profession. It isn't essential that the colors be the same by night as by day, but it is essential that the colors be attractive at all times. Shadow box testing has been evolved to offer us specific knowledge as to the effect of each type of lamp on each color. With access to these findings, the decorator can correct his mistakes.

But shadow box testing is not sufficient. More than one color is usually used in a room and the same lamp will not have the same effect in a room. The area tested is too small, and the average room has many right angles which change the appearance of the same color even in natural light.

Anyone interested in perfecting his method of operation may experiment with any information available. Recently a comprehensive test was made of the effect of different lamps on a wide range of colors. This test, applied to a room in which the larger and background areas are in the green or the blue family, would indicate that the daylight fluorescent lamp should be used for general illumination and that, depending on whether the accent colors are in the red, pink, and tan or yellow family, special lighting should be incandescent, warmtone, or soft white fluorescent.

Choice of Color

How and for what purposes a room is furnished affects the choice of color and the type and amount of light needed. Living rooms and bedrooms and quiet rooms are areas for relaxation and rest. Quiet colors, lower in value and chroma, with less contrast and adequate general light with specific light for specific tasks would be the rule. If the rooms are small, there may be need to give the illusion of space. This can be done in many ways. The simplest is to use shades and tints of one color for all areas with only enough contrasting color accents to prevent monotony. The careful colorist may take as much care in the mixing of the paint for each wall as he does when the visible colors are in different hues. To secure the best possible result in a room, the whites may range from a warm white mixed with red, a cool white mixed with green, a black white, where the white is greyed, and a brown white which is warm and greyed.

To retain this same effect at night, artificial light of the right type must be placed to reflect or absorb light at the same places natural light is reflected or absorbed. There being variance between incandescent lamps, and fluorescent lamps and between the types of fluorescent lamps, some testing is necessary. This type of lighting means additional light to that used for general illumination, and light for special tasks. Its function is to retain the color harmony and relationship. This light may be a part of the general illumination plan, but rarely will it serve to light a special task. If the budget is limited, a less subtle color plan should be selected and general illumination and special task lighting carefully adjusted to assume the function of retaining all room color values.

Colors for a dining room should be stimulating and also compatible with food colors. Not only should there be some direct light on the table, but there should be light in other parts of the room. These room lights may be concealed in vases or urns placed on cabinets or cove or valance lighting used.

The lighting in living-dining areas of the house is generally designed to create a mood and room atmosphere with special lighting for special tasks.

There should be color progression between all rooms of the home, especially those that open off each other. The same color scheme need not be used, but the colors should be related to rooms in direct view. Kitchen colors should harmonize with those in the dining room, be compatible with food colors and also not contrast too greatly with the glaring white of the major appliances. Here the constant use of white and too much reflected glare is beginning to cause universal unfavorable reaction toward the popular modern kitchen. In the next decade there will be a pronounced effort to solve the problem through the use of color and pattern in kitchens.

Much work has been done in industry to prevent accidents through careful use of color and light. This practice is suggested for homes, but rarely followed. All basement stairways should be properly lighted, and color should mark overhead beams. Floors should be contrastingly painted if there are sudden steps down or up. These markings are reminders which we sense as we see.

With new interior plans it will be far simpler to coordinate the physical and psychological aspects of color. Quiet areas may be partially partitioned to separate area activity, but when actual partitions are not essential, studied use of light and color to mark function or to prevent monotony will prove satisfactory. Quiet relaxing colors can be used. In areas where play and active work are allocated, more color and more types of light will be needed.

New color patterns will be established for the long corridors where sleeping rooms, study rooms, and dressing rooms are placed. Color variations in the doors break up the long, narrow spaces. Each sleeping cubicle is the compromise the new home plan makes to provide individual privacy and more space for more human needs. Color may take away from these the cell-like appearance. Adequate and properly placed light will help make the oversmall rooms workable. If color and light ratios are technically correct, study and work can be done happily.

Exterior lighting will help create the illusion of space at night, making the outside and inside more nearly one.

The small home owner must be given sources from which he can purchase the materials that will give him the color and light he needs. It has be-

come apparent that there are natural cycles of color popularity emphasized and dramatized through styling, merchandising and promotion.

Manufacturers and retailers are slowly and painfully establishing methods by which they can produce seasonal and livable colors and the suitable lamps and lighting to go with these colors.

Merchandising of color is becoming a fascinating and rewarding business. To fulfill the demand for a variety of colors and color combinations for decorative use in homes of all income groups, styles, and tastes, a wide selection and large inventory must be built which represents considerable investment. A paint manufacturer hesitates to introduce a new color unless he knows the public wants it. The same is true with a fabric or carpet manufacturer. When looms start to roll, it is too late to change the mind.

Now that light proves to play such an important part in maintaining the constancy of color, manufacturers of lighting equipment will need to join the ranks of the "what-will-sell-next" crystal gazers.

Color acceptance is part of the Fashion picture. We repeat: Fashion is change. There is some logic to the reasons for color change. But merchandising is another thing. Each manufacturer cannot be all things to all people. He should have confidence in his merchandise. He should carefully plan the colors for his merchandise within the limitation of his investment, knowing his competition but not fearing it. With confidence he then can inform his customers, and these customers inform Mr. and Mrs. Consumer as to the correct manner in which the merchandise may be used satisfactorily in the home. One color cycle is completed. But the wheel never stops.

Materials wear out, surfaces soil, families grow, new houses are designed, new inventions create new competition.

Exposure to color through magazines, movies, and soon-to-come color television quickens acceptance of new combinations of color, better use of color. This advantage has been limiting as some colors reproduce better than others, for many a beautiful scheme has been distorted in bad reproduction. Magazine illustration may be educational and informative, but there is some poster psychology utilized and colors are stepped up in value and intensity to attract the reader's attention. It is sometimes misleading to the uninformed should they not understand the function of color for illustration.

Constant exposure to these colors creates familiarity, acceptance, and demand. People about to try something new, tend to want specific and hard and fast rules to apply to their individual problems. This is not easy, as there are many variables.

Each home presents a different problem. The amount of funds available, the size of the house, its orientation and design, the age of the people, the accumulation or lack of accumulation of furnishings, the tastes, preferences, and prejudices of each individual member in a family, influence the application of known principles affecting the best use of color and light.

Each professional interested develops his own method of applying available information. He can test the effect of light on his colors at various testing laboratories. He can compare the charts and findings of surveys and tests. He can consult specialists in allied fields. Through honest experimentation and progressive experience he gains confidence in his ability and gains recognition.

A way must be found to assemble and correlate the experiences of decorators, designers and lighting specialists of unusual ability who instinctively use new materials, colors and ideas — without fully recognizing why or how. The study of the relationship of light and color must be continued, because color and light are an essential part of everyday life.

DISCUSSION

LILLIAN E. EDDY*: The authors are to be congratulated upon including in this paper an excellent summary of present-day practices of the use of color in the home. The uses of color summarized are well known by competent interior designers and decorators but, unfortunately, many people designing residential lighting installations have little knowledge of them. I trust this paper will encourage home lighting specialists to delve further into current trends of color in home furnishings and home decorations. Color is a powerful factor in present day home fashions and we must learn to apply the proper lighting. Witness the current issue of *House and Garden* which is devoted almost exclusively to color in the home and there is no mention whatever of artificial lighting. Table lamps are liberally illustrated but are discussed purely from the standpoint of the color of the shade as a factor in the color scheme of the room.

I was particularly pleased with the several references to the logical use of dark colors on walls. The lighting industry has long recommended walls with high reflectance factors to make the lighting system more efficient and to provide easier seeing conditions. However, we are faced with the fact that many decorative schemes call for darker walls and many people prefer them psychologically. This is particularly true in residences. It is my contention that, as lighting specialists, it is our job not to change the color of the walls but to design

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lighting installations that make these walls as usable and as livable by night as by day.

I take one exception to the use of darker walls mentioned in the paper. It is recommended that if a desk is backed directly up to a wall, the wall facing the desk should be in a subdued color, even though the other walls in the room are somewhat lighter. In a paper previously presented at a National Technical Conference it was recommended that walls facing desks should have a reflectance factor of 45 to 65 per cent.[1]

The problem of selecting the proper white fluorescent lamp to correctly balance the colors at night has not been solved. The use of color boxes seems to be the best solution at the present time. I agree with the authors that the area in these color boxes is too limited. Also I have found that the level of illumination in the average color box is too high to give a correct answer to how the color swatches will look when used in the home. In the average color box equipped with a 20-watt fluorescent lamp the color swatches are viewed in a vertical position under levels of illumination varying from 125 footcandles at the top of the box to 10 footcandles at the bottom. When viewed on the floor of the box the average level of illumination is 50 footcandles. The draperies, floor coverings and walls will rarely receive this high level of illumination when installed in the home. Colors appear differently under varying levels of illumination. I have seen many instances of two pieces of fabric which appeared to match in a daylighted room that obviously were not matches under the much lower level of artificial lighting. In other cases I have found just the opposite to be true.

I think it behooves the designer of residential lighting to take lessons from the designer of commercial lighting who has so successfully used a combination of fluorescent and filament lighting in the same interior. Fluorescent lighting has been used for general overall illumination and filament lighting for highlighting individual elements. With the multiplicity of residential lighting equipment now available it is perfectly feasible to do this in the home. Jobs that I have worked on which have proved most satisfying to the occupants of the home have always contained a mixture of fluorescent and filament lighting.

In an article[2] recently prepared by Dr. Matthew Luckiesh, he points out that the problem of the color of artificial lighting became obvious nearly forty years ago when, shortly after the advent of the tungsten filament lamp, a flame tint lamp was made which emitted light of approximately the same color and spectral character of the light from the candle flame. For uncounted thousands of years artificial light had been obtained by burning various material. Consequently a warm yellowish tint had been associated with artificial light. To many persons the light from the tungsten filament lamp at first appeared to be too cold. Millions of flame tint tungsten filament lamps were sold to satisfy aesthetic sensibilities in certain fields of lighting such as the home. As the homemaker became acclimated to the whiter light of the tungsten filament lamp, the use of flame tint lamps gradually disappeared until today we only find them in rare spots. Perhaps we are going through this same cycle with fluorescent lighting in the home today. There is little doubt but what psychology plays a large part in color. The end of another decade may see all this confusion in colors of lamp bulbs ironed out. In the meantime it is our job to attempt to find the best possible solution to the problems at hand and come out with interiors that are as charming, restful, and comfortable by night as by day, no matter what pigments or what light sources are used.

1. "Studies of Lighting and Seeing for the Student at Home," by Mary E. Webber, ILLUMINATING ENGINEERING Vol. XLIV No. 5.
2. "Making Mountains out of Mole Hills," by Dr. Matthew Luckiesh.

EMILY ALEXANDER*: Like the man who goes to Church regularly although he knows little about the Bible, I say amen to Miss Miller's remarks. We realize that light and color, like the warp and woof threads, determine not only the pattern, but also the texture and strength of the fabric. We who are home lighting advisors recognize the terrific need for color information. Likewise, the people in the decorating field need lighting information. Frankly, I don't know about Miss Miller's slides showing dark walls and light furniture, or light walls and dark furniture. Perhaps it's the tendency to be *down* on something you are not *up* on.

The trend to purchase that with which one is familiar poses a problem to us. We have been struggling to encourage our customers to apply the familiar comfortable seeing conditions found out-of-doors to the inside of the home. To do this, we need light walls and ceilings to maintain low contrast plus increased levels of illumination. We encounter a resistance for people have been accustomed to dark interiors for generations.

We are struggling to get the cooperation of the decorators for we want and need their help. I know of nothing that would please the lighting advisor more than to be allowed to consult and work with the decorator. They seem to look upon us as the women who will work with anyone who uses light and charge nothing for our services. We seem to be for the masses, and they for the exclusive trade.

We are making slow progress for many are recognizing the use of light, but few are recommending adequate light. The public utility in our area comprises the principal source of certified lamps — the shops with which the decorators are associated have few if any really good portable light sources.

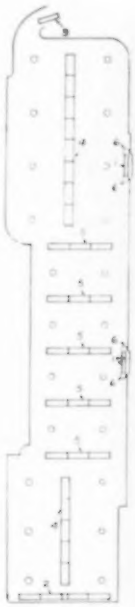
When the I.E.S. table study lamps were introduced, women would buy them strictly for study lamps. Many times they were placed in the closet during the day. Before the war portable lamps we considered a good light source were considered too tall by the decorators' standards. Now, the field girls tell me the 25-inch C.L.M. lamp is often thought to be too *low!*

Beauty and utility in lamps are now courting each other, and it is my hope that they will soon be wedded to the satisfaction of the decorators.

*Georgia Power Company, Atlanta, Georgia.

Lighting for a Shoe Store

LIGHTING OBJECTIVE: To provide an attractive interior and a high level of illumination for trying on and appraising women's footwear.



Installation at Chandler's Shoe Store, 319 Wisconsin Street, Milwaukee, Wisconsin; W. Emil Forman, Architect.

General Information: This irregularly shaped 2500 square-foot sales area has plaster walls painted gray and a beige carpet. The twelve-foot high ceiling is finished in smooth off-white plaster.

Installation: An average illumination of 85 footcandles is provided by 3500K fluorescent lamps supplemented by downlights for highlighting the try-on area. (See Plan View) The total lighting load is 7.24 watts per square foot. Brightnesses are as shown in the table.

	Equipment (See sketch)			*Location*	*Footlamberts*
0	Solar	Catalogue	#2916	(300-watt filament lamp)	Ceiling, center of room between troffers	125
1	"	"	2248	(2 48" 40-w fluorescent)	Upper wall, below vent	32
2	"	"	7448-GA	(4 48" 40-w fluorescent)	Side wall, rear of store	25
3	"	"	7248-GA	(2 48" 40-w fluorescent)	Wall, inside wall case	100
4	"	"	12448	(4 48" 40-w fluorescent)	#12448 luminaire, lengthwise 45° (Albalite glass)	500
5	"	"	3541	(6 48" 40-w fluorescent)	#2916 luminaire, 45°	1400
6	"	"	163	(150-watt spot lamp)	#3541 troffer (Albalite glass)	1000

Lighting data submitted by James A. Hodges, Solar Light Manufacturing Company, 1357 S. Jefferson Street, Chicago, as an illustration of good lighting practice and to aid in the design of similar installations.

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A.I.A. File No. 31/14

Annual Report of the General Secretary—1948-1949

A. H. MANWARING

THE YEAR ending September 30, 1949 includes achievements which continue to set records unsurpassed in the forty-three year history of the Society. The membership reached an all-time high of 6883. The details of this remarkable record of growth are given in graphs and charts in the body of this report. The program of the Society involved an annual budget of over $180,000 to maintain the services which the Society now renders to its members and through them and its publications, to the whole lighting industry and for the public welfare. Of considerable significance was the very fine increased support given by the 315 Sustaining Members who through their dues make possible a large measure of the Society's program.

Stimulated by growing interests, centered on the fine work of our local representatives, six new Chapters were added to the roster of local groups, making another all-time high of 47 Sections and Chapters in the United States and Canada. The cooperative effort of the local groups resulted in excellent Regional Conferences being held in seven of the nine Society Regions.

The Technical Program of the Society continued to grow under the direction of the National Council and the guidance of our Technical Director C. L. Crouch. Over a thousand members of the Society served in the 93 general, task and technical committees carrying out the Society's administrative and technical program.

Following the development of the new Publications Program in 1948, headquarters added the necessary secretarial personnel—these together with the staff members serving the technical program and the business operations of the Society now total 21 under the capable leadership of A. D. Hinckley, Executive Secretary, C. L. Crouch, Technical Director and G. Ross Henninger, Director of Publications.

Membership

The tabulations included with this report will record the elections, losses and net gains for the current year and will show the membership totals in comparison with the totals at the conclusion of the previous years. It is evident from a comparison of these figures that the membership growth during 1948-1949 has been slowed down considerably. This year's membership campaign activities were conducted under the chairmanship of Frank R. Knowles on a campaign basis similar to that followed in the two previous years. The slower growth was evidently in sympathy with the trends in the general economic picture and the committee anticipates that the Society will face similar problems in relation to the economic trend.

Especial efforts were made by the committee this year in assisting in the follow-up on unpaid membership dues accounts to reduce the number of delinquent members dropped at the June Council meeting. Sections and Chapters were furnished with lists of the delinquent members several times during the spring months for this purpose.

As in the previous membership campaigns a special activity for the local representatives was carried on under the chairmanship of James H. Hull. In this activity the committee continued to meet the problem of estab-

Presented at the National Technical Conference of the Illuminating Engineering Society, French Lick, Indiana.

The meeting of Council held in June, 1949, at the Hotel Roosevelt, New York City.

TABLE I—Membership as of September 30

	1944	1945	1946	1947	1948	1949
Members Emeritus	16	15	16	16	21**	26***
Fellows	0	10	21	42	45	44
Members	555	766	986	1,201	1,406	1,521
Associate Members	3,120	3,332	3,878	4,335	4,908	5,048
Student Members	23	33	45	71	136	244
Total	3,714	4,156	4,946	5,665	6,516	6,883
*Wartime Dues Waived	403	421	220	.....	.....	.....

*These members are included in the total.
**Includes 3 Fellows of the Society.
***Includes 5 Fellows of the Society.

TABLE II—Gains and Losses in Membership During Year Ending Sept. 30, 1949

	Members Emeritus	Fellows	Members	Associate Members	Student Members	Total
October 1, 1948	21	45	1,406	4,908	136	6,516
Gains						
Elections	....	....	76	857	150	1,083
Reinstatements	....	....	20	59	2	81
Transfers	5	2	76	19	1	103
Total Gains	5	2	172	935	153	1,267
Losses						
Resignations	....	....	20	272	26	318
Dropped	....	....	24	419	....	443
Deceased	....	1	9	26	....	36
Transfers	....	2	4	78	19	103
Total Losses	....	3	57	795	45	900
Net Change	+5	—1	+115	+140	+108	+367
Total membership as of September 30, 1949	26	44	1,521	5,048	244	6,883

lishing fair and equitable quotas for the local representatives. Much of the development of student membership during the past five years has resulted from the work of the local representatives at the various colleges and universities.

The Section and Chapter Membership Campaign activity was under the general direction of Garlan Morse, Vice-Chairman, and in several of the local groups excellent results were obtained. The cash prize awards in the Total Membership Contest were: first prize $100.00, Ohio Valley Section; second prize $50.00, Montreal Section; third prize $25.00, Northern California Section. The awards in the Member Grade Contest were: first prize $25.00, Montreal Section; second prize $15.00, New Orleans Chapter; third prize $10.00 shared by the Cornhusker Chapter and Georgia Section.

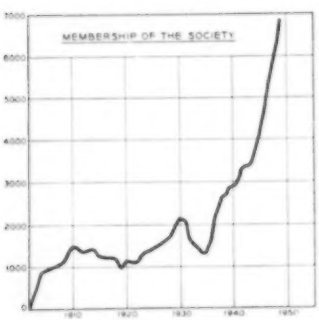

Figure 1.

Deceased

The Society records with sorrow the passing of 1 Fellow, 9 Members and 26 Associate Members during the year.

Fellow

Preston S. Millar

Members

A. M. Atkinson	H. J. Mayo
G. M. Boyd	J. F. Mayo
C. M. Brand	W. H. Woods
W. R. Greer	P. N. Young
M. L. Macht	

Associate Members

L. M. Barrows	A. H. Forman
C. J. Booth	L. E. Harris
J. L. Brana	Morris Hunter
H. P. Brill	E. B. Kirk
J. L. Calpin	J. H. Kurlander
W. B. Carroll	Carl Lau
E. V. Conroy	E. J. Lehman
I. S. Covington	C. O. Lindstrom
A. S. Detsch	G. K. McDougall
J. S. Dow	J. H. McGraw
R. H. Edwards	R. E. Staples
L. E. Fenlon	T. C. Teel
W. T. Foley	H. R. White

Members Emeritus

Five members of the Society were elected to the grade of Member Emeritus during the past year having retired from regular occupation after having performed for the Society services of such meritorious character as the Council deemed worthy of this honorable award. They are:

L. A. Hawkins — C. C. Munroe
V. Lansingh — J. L. Stair
W. R. Whitney

Fellows

Two members were recommended by the Board of Fellows for election to Fellow Grade as having met the Constitutional requirements. After report at the June Council meeting the following were elected by letter ballot of Council:

F. C. Breckenridge
Val J. Roper

Local Activities

The annual local activities conference of Section and Chapter officers, local representatives and national officers was held in New York on June 9 with Walter Sturrock, Chairman, Local Activities Committee, presiding. The discussions covered subjects of current interest which included the following:

1. Section and Chapter meetings—Educational programs—Use of Society's publications—Availability of Speakers on timely subjects.
2. Section and Chapter activities other than scheduled meetings—Architectural lighting competitions—Prize awards for lighting jobs.
3. Residence lighting forums.
4. Section and Chapter areas of operations, budgets, extension work.
5. Local Representatives activities.
6. I.E.S. membership grades—Interpretation of requirements, membership campaigns.

As in former years, the discussions on the foregoing subjects were particularly helpful to those in attendance.

Extending the Society's Activities into New Areas

(a) New Chapters and Branches

During the year the following local groups were granted charters:

University of Illinois Student Branch, Urbana, Illinois—Charter approved October 14, 1949 & February 9, 1949.

Mississippi State College Student Branch, State College, Miss.—Charter approved April 2, 1949.

University of Cincinnati Student Branch, Cincinnati, Ohio—Charter approved April 2, 1949.

Tennessee Valley Chapter, Nashville, Tennessee—Charter approved February 9, 1949.

TABLE III—Membership of Sections and Chapters as of September 30, 1949

	Members Emeritus	Fellows	Members	Associate Members	Student Members	Total
CANADIAN REGION						
Hamilton, Ontario Chapter	....	1	6	39	....	46
Maritime Chapter	....	....	7	20	....	27
Montreal Section	....	....	28	88	1	117
Ottawa Chapter	....	....	10	29	....	39
Quebec Chapter	....	....	7	23	....	30
Toronto Section	....	2	38	124	5	169
Winnipeg Chapter	....	....	8	35	....	43
EAST CENTRAL REGION						
Baltimore Chapter	....	....	15	71	....	86
Capital Section	1	3	31	68	2	105
Eastern Pennsylvania Chapter	....	....	50	150	2	202
Philadelphia Section	2	2	73	178	1	256
Pittsburgh Section	....	....	53	154	4	211
GREAT LAKES REGION						
Central New York Chapter	1	....	18	66	1	86
Cleveland Section	2	11	109	262	23	407
Michigan Section	1	....	44	198	5	248
Ohio Valley Section	1	....	33	92	44	170
Rochester Chapter	....	....	9	57	....	66
Western New York Section	....	1	10	58	....	69
MIDWESTERN REGION						
Chicago Section	3	4	134	396	76	613
Cornhusker Chapter	....	....	11	62	....	73
Heart of America Section	....	....	22	88	2	112
Indiana Chapter	....	....	20	101	3	124
Iowa Section	....	....	18	88	1	107
Milwaukee Chapter	....	1	19	118	7	145
St. Louis Section	....	....	22	82	1	105
Twin City Section	1	....	28	141	....	170
NORTHEASTERN REGION						
Connecticut Section	2	3	31	96	1	133
New England Section	1	3	71	253	3	331
New York Section	8	6	166	353	6	539
PACIFIC NORTHWEST REGION						
British Columbia Section	....	....	14	86	5	105
Inland Empire Chapter	....	....	6	47	....	53
Oregon Section	1	....	21	79	....	101
Puget Sound Section	....	....	17	80	1	98
SOUTHERN REGION						
Carolinas Chapter	....	....	17	45	1	63
Florida Chapter	1	....	26	61	....	88
Georgia Section	....	....	39	98	....	137
New Orleans Chapter	....	....	18	69	26	113
Southeast Florida Chapter	....	....	9	26	....	35
Tennessee Valley Chapter	....	....	11	54	....	65
SOUTH PACIFIC COAST REGION						
Mother Lode Chapter	....	....	13	28	....	41
Northern California Section	1	2	47	182	12	244
Southern California Section	....	3	61	174	4	242
Utah Chapter	....	....	15	35	....	50
SOUTHWESTERN REGION						
Alamo Chapter	....	2	10	47	....	59
Rocky Mountain Chapter	....	....	15	73	1	89
South Texas Chapter	....	....	15	62	....	77
Southwestern Section	....	....	31	156	4	191
Foreign Non-Section	....	....	45	156	2	203
TOTAL	26	44	1,521	5,048	244	6,883

Carolinas Chapter, Charlotte, North Carolina — Charter approved February 9, 1949.

Maritime Chapter, Saint Johns, New Brunswick—Charter approved April 2, 1949.

Southeast Florida Chapter, Miami, Florida—Charter approved May 11, 1949.

Quebec Chapter, Quebec City, Canada—Charter approved June 8, 1949.

Winnipeg Chapter, Winnipeg, Manitoba, Canada—Charter approved June 8, 1949.

The growth in membership and work in two of the present active Chapters made them eligible for a Section status and by the usual petition the change was made as follows:

Connecticut Chapter to Section—Charter approved February 9, 1949.

British Columbia Chapter to Section — Charter approved February 9, 1949.

(b) Section and Chapter boundary lines —

In order to extend the Section and Chapter activities into all areas of the U. S. and Canada, a study was made of all unassigned areas, and by action of Council on June 8 the boundaries of operation of certain Sections and Chapters were extended to include all previously unassigned areas. By this action, all local representatives of the Society automatically become members of the Section or Chapter in that area and by close cooperation can take advantage of all of its available facilities in carrying on the activities of the Society.

Regional Conferences

During the past year, seven of the nine Regions held their regular conference. These were as follows:

March 3-4 — South Pacific Coast — San Francisco, California

March 10-11 — Pacific Northwest — Portland, Oregon

April 10-12 — Southwestern — Houston, Texas

April 28-29—Canadian—Toronto, Canada

May 12-13 — Northeastern — Hartford, Connecticut

May 23-24 — Great Lakes — Rochester, New York

June 6-7 — East Central — Harrisburg, Pennsylvania

The planning of regional conferences has, during the year, required careful study, both from the standpoint of suitable advance hotel accommodations and for coordination of conferences with other scheduled meetings and thereby facilitating travel by the President and others concerned. This has resulted in a tentative schedule of regional conferences for the 1949-50 year with dates and places specified to facilitate planning for the year.

Election of Chapter and Branch Officers

Although there is no specified time in the National Constitution and By-Laws when Chapters and Branches shall hold their annual election of officers, it has been emphatically recommended that such elections be held at the same time as those for Section and National officers, and that the names of the officers-elect be reported to the General Secretary by May 30.

Representatives to Other Organizations

The Society continued to cooperate with related associations and other agencies in the fields of science and standardization. Sixteen members represented the Society on 17 Sectional Committeees of the American Standards Association. Members of the Society also served as official representatives to:

American Association for the Advancement of Science

Armed Services NRC Vision Committee

Industry Committee, Handbook of Interior Wiring Design

Meetings of Sections and Chapters for Year Ending September 30, 1949

	Number of Meetings	Total Attendance	Average Attendance
CANADIAN REGION			
Hamilton, Ontario Chapter	7	377	54
Maritime Chapter (Chartered 4/2/49)	1	53	53
Montreal Section	6	389	65
Ottawa Chapter	10	558	56
Toronto Section	8	597	75
Quebec Chapter (Chartered 6/8/49)	....	....	....
Winnipeg Chapter (Chartered 6/8/49)	....	....	....
EAST CENTRAL REGION			
Baltimore Chapter	6	519	85
Capital Section	7	437	63
Eastern Pennsylvania Chapter	8	1,184	148
Philadelphia Section	9	1,798	199
Pittsburgh Section	9	841	94
GREAT LAKES REGION			
Central New York Chapter	8	273	35
Cleveland Section	8	801	100
Michigan Section	10	1,777	178
Ohio Valley Section	8	791	99
Rochester Chapter	8	536	67
Western New York Section	8	486	61
MIDWESTERN REGION			
Chicago Section	10	1,570	157
Cornhusker Chapter	6	808	135
Heart of America Section	8	454	57
Indiana Chapter	8	325	41
Iowa Section	3	236	79
Milwaukee Chapter	11	1,325	121
St. Louis Section	8	360	45
Twin City Section	9	1,304	145
NORTHEASTERN REGION			
Connecticut Section	8	502	63
New England Section	8	715	89
New York Section	8	961	120
PACIFIC NORTHWEST REGION			
British Columbia Section	6	310	52
Inland Empire Chapter	7	584	84
Oregon Section	10	466	47
Puget Sound Section	8	286	36
SOUTHERN REGION			
Carolinas Chapter (Chartered 2/9/49)	2	124	62
Florida Chapter	5	358	72
Georgia Section	8	559	70
New Orleans Chapter	8	680	85
Southeast Florida Chapter (Chartered 6/8/49)	2	65	33
Tennessee Valley Chapter (Chartered 2/9/49)	3	125	42
SOUTH PACIFIC COAST REGION			
Mother Lode Chapter	7	269	39
Northern California Section	7	573	82
Southern California Section	10	1,190	119
Utah Chapter	7	262	38
SOUTHWESTERN REGION			
Alamo Chapter	9	342	38
Rocky Mountain Chapter	7	387	55
South Texas Chapter	9	409	46
Southwestern Section	8	252	32
GRAND TOTAL—SECTIONS AND CHAPTERS	341	27,218	82

Institute of Traffic Engineers

Inter Society Color Council

National Committee on Traffic Safety

National Engineering Advisory Comm.

National Office Management Association

National Research Council, Division of Engineering and Industrial Research

National Research Council, Highway Research Board

President's Highway Safety Conference

U. S. National Committee of the International Commission on Illumination

U. S. National Commission of U.N.E.S.C.O.

Technical Director's Activities

The Society's technical program during the past five years has been expedited by the Technical Director, Mr. C. L. Crouch. His report for this past year includes working with the technical committees (31 major committees, 59 sub-committees), liaison with 17 other organizations, answering 650 inquiries for technical information. Mr. Crouch also spends one-third of his time as secretary and technical adviser to the I.E.S. Research Fund. The employment of Miss Eve Freyer, Mr. Crouch's engineering assistant, together with the loyal support of his other three staff members have facilitated the handling of technical activities.

A summary of the year's accomplishments in the Technical Department is as follows:

1. Attended 63 committee meetings.
2. Aided in revision and preparation of the 14 committee reports entitled: (20 drafts involving over 900 pages of typing)

Guide for Outdoor Illumination Tests Part I, Street and Highway; Part II, Sports

Lighting Fundamentals Course

Lighting for Bakeries

Lighting for Canneries

Lighting for Flour Mills

Lighting for Machining of Small Metal Parts

Lighting for Steel Mills—Part I, Open Hearth

Lighting in Woolen and Worsted Industry

Lighting Equipment Engineering Data Sheet

Recommended Practice for Daylighting

Recommended Practice for Industrial Lighting

Recommended Practice—Lamps for Aviation Lighting

Recommended Practice for Library Lighting

Uniform Methods of Presenting and Calculating Room Indexes, Coefficients of Utilization and Maintenance Factors

3. Answered 650 technical inquiries by means of correspondence and telephone.
4. Data Sheets—Series XIV were completed (24 sheets) and data obtained for Series XV.
5. Eight lectures were given before Sections, Regional Conferences, medical organizations and universities.
6. Liaison with other organizations included:
   a. *I.E.S. Research Fund*—attended six meetings and had 22 conferences regarding proposals and activities. Obtained nine new proposals; five were approved and contracted for.
   b. *American College of Surgeons and American Hospital Association*—Obtained representation on Hotel and Hospital Lighting Committees.
   c. *American Institute of Architects*—worked jointly with their Department of Education and Research and two of our committee chairmen regarding a study of college residence halls.
   d. *American Standards Association*—
      (1) "Recommended Practice of Office Lighting"—circulated to 27 national organizations for balloting as to acceptability as an American Standard.
      (2) Negotiated for co-sponsorship in preparing American Standard "Protective Lighting for Industrial Properties."

(3) Discussion of possible overlapping of Z 7 and Z-58 Committees in activities concerned with proposed new nomenclature.

e. *Armed Services NRC Vision Committee* — Attended two meetings. Discussed a paper presented which resulted in a statement of illuminating engineers' methods of approach to lighting application problems. This was circulated to I.E.S. officers and committee chairmen.

f. *Harvard University—Baker Memorial Library* — Obtained story on relighting of Library.

g. *Inter-Society Color Council*—Negotiating re co-sponsorship on research in color preferences.

h. *Massachusetts General Hospital* and *N. Y. City Department of Health* — Meetings re beryllium compound poisoning from fluorescent lamps.

i. *National Institute of Cleaners and Dyers* — Approached Director of Trade Relations in interest of setting up study in industry.

j. *National Safety Council* — Coordinated efforts of Street and Highway Traffic Safety Bureau and I.E.S. Street Lighting Committee to aid NSC in activities of preventing accidents.

k. *National Society for Prevention of Blindness*—Conferences with Director re work of mutual interest in illumination.

l. *New York University, School of Medicine* — Cooperated with the National Society for Prevention of Blindness in taking illumination measurements in the Carlisle Room (library and study room) and preparing performance data as published in the September issue of ILLUMINATING ENGINEERING.

m. *Ophthalmological Foundation, Inc.* —Assisted in arranging illumination and uniform brightness of a screen to be used in eye training program for myopes.

n. *U. S. Public Health Service*—Continued negotiations toward developing booklet on "How to Make a Lighting Survey" in joint activity with I.E.S. Committee on Lighting Education.

I.E.S. Research Fund

The past year has witnessed the most vigorous activity of the Fund's existence and the smoother working of the administrative operations. Further, there have developed greater opportunities for the use of the facilities and personnel of educational institutions who have the experience background for research of importance to the illumination field. The shortage of graduate students or research personnel available has lessened and no longer appears to present a problem.

The general research situation remains much the same as last year with the Armed Services continuing to sponsor an extensive program of research in the universities and laboratories. Considerable of this work is of interest and benefit to the illumination field, especially the visual research which is concerned with basic problems of relationship of light and vision. Due to this activity during the war and since, facilities have now been developed with considerable experience to carry on further studies of primary interest to the Fund. This fact has been utilized in contracting for a number of strategic projects this year.

From the nominations submitted by the Council, the Board of Trustees re-elected Dr. Conrad Berens, Director of the Ophthalmological Foundation, and Secretary of the Committee on Optics and Physiology, as a Trustee, to serve until October 20, 1953. The Board also re-elected Prof. John O. Kraehenbuehl as a member of the Research Executive Committee and added Ralph M. Evans, Superintendent in charge of color quality and control, of the Eastman Kodak Company. Officers serving in the year beginning October 1948 included:

A. F. Wakefield, Chairman of the Board
A. H. Nicoll, Treasurer
C. L. Crouch, Secretary
Ward Harrison, Chairman, Research Executive Committee

The Research Executive Committee was active throughout the year in considering the increasing number of proposals which were mostly solicited or developed through participation in the Society's technical activities. Of the 18 proposals received, 14 were the direct result of needs expressed through the Society's Technical Committee work.

As a result of the Executive Committee deliberations, 9 of the proposals were approved for transmittal to the Trustees with recommendations for favorable consideration. Approval of several was made conditional upon revision of proposals to suitable form. Through action on several of the proposals, the Executive Committee interpreted the research activity of the Fund as being limited to work related to "Fundamental principles and/or test methods" and therefore the funds could not be devoted to lighting application studies, application calculations or development and interpretation of extant literature into useful form.

Technical Advisory Subcommittees were set up for 5 projects and others are being appointed as the projects are being contracted. Three Committees are very actively following the work of the projects which are in progress.

Projects approved and under way during the year included:

Controlling and Redirecting Daylight with Louvers—University of Michigan—Prof. H. S. Bull.

Verification of Interreflection Formulae —University of Michigan—Prof. H. S. Bull.

Measurement of Work Done by Extrinsic Ocular Muscles—Massachusetts Institute of Technology—Dr. Kurt S. Lion.

Flicker-Fusion Threshold as a Measure of Visual Fatigue—Cornell University—Dr. M. E. Bitterman

Spatial and Temporal Characteristics of Retinal Inhibition—Ohio State University—Dr. Glenn Fry.

Effect of Task Brightness to Surround Brightness Ratios on Visual Performance —Southern Methodist University—Prof. R. L. Biesele, Jr.

Effect of Spectral Composition of Illumination on Visual Performance — University of Toronto—Prof. D. Y. Solandt, M.D.

Visibility Test Methods—Cornell University—Prof. C. L. Cottrell

Pavement Surface Reflectance—University of Illinois — Prof. J. O. Kraehenbuehl.

Muscle Action Potentials as a Measure of Visual Performance Cost—Tufts College—Dr. John Kennedy.

Of the total amount in subscriptions to the Fund ($55,275.00), all but $3000 has been expended on approved projects or has been committed for allotment.

There has been no solicitation and no new subscriptions to the Fund since 1946. The balance for new projects indicates the urgent need for more funds to carry on a valuable research program which has just nicely begun.

Standing Committees

Council Executive

Lee E. Tayler, Chairman

This committee has the responsibility of conducting the affairs of the Society between the Council meetings which are regularly held bi-monthly from October to June inclusive. The increased volume of administrative problems during the year is reflected in the records of the Executive Committee which held 8 meetings.

Finance

C. C. Keller, Chairman

Details of the year's financial operation are given in the balance sheet and statement included in the appendix of this report.

As shown in the report of the committee last year, the budget was to be an all time high — over $200,000.00. While a balanced budget, including $10,000.00 to reserve was adopted by the Council in October, it became apparent soon after the turn of the year that income would fall far short of expectations. It has been felt that the general decline in business was mainly responsible for this situation since the reduction came about in all departments producing income except in sales of reprints, handbooks, etc. This then called for a careful and closer examination of expenditures and the year was therefore devoted largely to maintaining a close check on all Society expenditures. With the continued cooperation between the Publications Committee, the Council Executive Committee, and the Finance Committee the Society is completing the year with a minimum drain on the reserve.

In considering the matter of revenue, it is of interest to note that the present reserve meets the constitutional requirement. However, the Committee on Finance and the Executive Committee have recommended as desirable a minimum cash reserve of $50,000.00 under present Society conditions.

The Finance Committee is cooperating with the special task committee appointed to study the dues of members of all grades and a report to the Council will be made at a later date.

Statement of Income and Expense for the Year Ended September 30, 1949

Income		
Annual Dues:		
Members (less discounts $1,226.00)	17,842.00	
Associate Members (less discounts $3,580.00)	48,293.62	
Student Members	740.50	
Fellows (less discounts $43.00)	645.00	
Entrance Fees	2,445.00	69,966.12
Sustaining Members		40,335.00
Sales, Publications, Gross Income		
IES Lighting Handbook	11,681.79	
Lighting Data Sheets, Binders	1,850.68	
Reprints	10,792.99	
ILLUMINATING ENGINEERING	6,214.36	
National Technical Conference Preprints	399.00	30,938.82
ILLUMINATING ENGINEERING, Advertising		47,672.24
Sales, Badges and Certificates, Gross Income		520.50
Interest		
Investments	642.50	
Bank Balances	23.57	666.07
1949 National Technical Conference Income	8,078.28	
Less: Expense	7,969.05	109.23
Total Income		190,207.98
Expense		
General		1,090.25
Office, Business	43,181.27	
Office, Technical	20,925.88	
Office, Publications	33,174.71	97,281.86
Organization, Committees	1,951.47	
Regional	498.22	
Sections and Chapters	13,746.38	
President's Travel	2,000.00	18,196.07
Sales, Badges and Certificates, Cost of Stock		324.13
Depreciation—Furniture and Fixtures	400.00	
Publications Stock	345.41	745.41
ILLUMINATING ENGINEERING, to members (October-December 1948)	7,880.52	
to members (January-September 1949)	32,912.11	40,792.63
Sales, Publications, I. E. Advertising Promotion		2,353.58
Sales, Publications, Cost of Stock		
IES Lighting Handbook	2,935.88	
Lighting Data Sheets, Binders	653.68	
Reprints	6,024.68	
ILLUMINATING ENGINEERING	3,398.62	
National Technical Conference Preprints	281.63	13,294.49
Sales, Publications, Cost of Services, Promotion		4,961.86
Total Expense		179,040.27
NET INCOME		11,167.71

Figure 2.

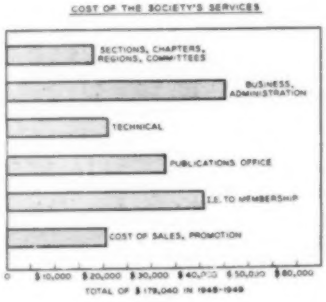

Figure 3.

Board of Fellows

Frank A. Hansen, Chairman

During the current fiscal year the Board of Fellows operated under procedures which have been developed since the establishment of Fellow grade by the Society. The Board has continued to be ready to consider nominations submitted by the required five Fellows or Members of the Society or from among the Board itself. During the year no new nominations were added to the existing file of nominations previously considered and a careful review was made of all previous nominations on which final action was still to be taken.

Because of the geographical dispersion of the Board all work of the Board was carried on as usual by correspondence.

A particular problem encountered during the year was the nomination of a Member of the Society residing in England whose nomination was locally sponsored rather than by the five Fellows or Members of this Society.

Comparison of Income and Expense for the Past Three Years

	1946-1947	1947-1948	1948-1949
Income			
DUES			
Fellows	513.75	615.00	645.00
Members	13,024.25	15,753.50	17,842.00
Associate Members	40,054.53	46,164.75	48,293.62
Student Members	210.00	384.00	740.50
Entrance Fees	——	2,460.00	2,445.00
Sustaining Members	28,705.63	30,209.37	40,335.00
SALES			
Publications Gross	11,097.21	17,340.36*	30,938.82
I. E. Advertising	——	——	47,672.24
Badges and Certificates	580.00	528.85	520.50
INTEREST	943.70	709.63	666.07
CONFERENCE, Net Income	491.31	1,538.75	109.23
TOTAL INCOME	95,620.38	115,704.21	190,207.98
Expense			
GENERAL	911.24	1,502.65	1,090.25
OFFICE	40,925.62	60,832.83	——
Business	——	——	43,181.27
Technical	——	——	20,925.88
Publications	——	——	33,174.71
ORGANIZATION			
Committees	1,520.07	2,856.17	1,951.47
Regional	——	420.82	493.22
Sections and Chapters	11,365.45	13,622.78	13,746.38
President's Travel	1,940.61	1,500.00	2,000.00
SALES, Badges and Certificates	388.30	330.39	324.12
Depreciation	748.98	840.00	745.41
ILLUMINATING ENGINEERING to Members	19,290.66	24,483.99	40,792.63
Sales, Publications, Cost Stock, Services	5,219.01	5,581.87	20,609.93
Miscellaneous	114.57	4,003.71**	——
TOTAL EXPENSE	91,424.51	115,975.21	179,040.27
NET INCOME	4,195.87	—271.00	11,167.71

*Includes $4,325.45 net income, I.E.S. Lighting Handbook, 1944-1948.
**Expense incident to establishing new Publications Program.

COMPARISON OF INCOME AND EXPENSE FOR THE PAST THREE YEARS

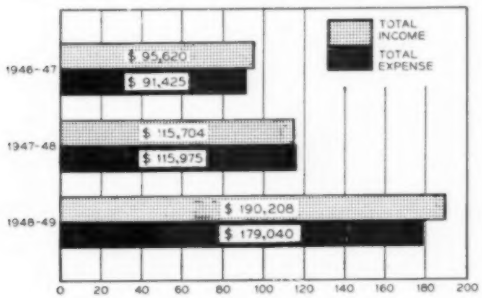

Figure 4.

Balance Sheet — September 30, 1949

Assets		
Cash in Banks		10,537.36
Petty Cash Fund		300.00
Accounts Receivable		8,822.67
Investments — (Cost)	20,675.25	
Accrued Increment — U. S. Savings Bonds	567.00	21,242.25
Inventories		8,269.64
Furniture and Fixtures	10,394.35	
Less: Reserve for Depreciation	6,051.66	4,342.69
Deferred Charges to Expense of 1949-50		
Sections and Chapters	1,926.69	
Miscellaneous	6,607.31	7,534.00
Accrued Interest on Investments		67.06
Total Assets		62,115.67
Liabilities and Surplus		
Liabilities:		
Accounts Payable	2,416.33	
Employees' Income Taxes Withheld	41.00	2,457.33
Deferred Income to Year 1949-50		
Dues Received in Advance	1,000.97	
Subscription Income Received in Advance	2,593.40	3,594.41
Surplus		56,063.93
Total Liabilities and Surplus		62,115.67

During the year the Board recommended that the Society present a Fellow Emblem to Fellows in recognition of their grade. Final action of the Board during the year was the recommendation to Council on the election of two Members to the grade of Fellow resulting in Council's action as reported under the Honors Section of this report.

General Board of Examiners

R. C. Kinney, Chairman

The Board has carefully studied all applications, and has weighed the recommendations of members with due consideration for the background and history of each applicant.

The war and post-war periods have had their effects on advancement of many students and younger engineers from Associate to Member grade. Recent applications from some Sections and Chapters indicate increased interest among electrical contractors in becoming Members.

The majority of our Section and Chapter officers do an excellent job of processing and following member elections. Unfortunately, some officers have been very negligent and have not given new applicants the friendly hand and counsel our Society is known for. We bespeak for applicants the same consideration each of us would welcome in a similar position. This guidance and a helping hand to new members is most important to the continued growth of our Society.

Papers

Hoyt P. Steele, Chairman

The responsibility of the committee this year was limited to the approval of Papers for presentation at the National Technical Conference. The approval of all other material published in ILLUMINATING ENGINEERING was not included in this responsibility.

The committee has met with considerable success in securing from a large number of qualified authors an excellent group of papers for presentation at the French Lick National Conference. The success of this activity can be measured by the success of the technical sessions at French Lick.

Publications

E. C. Huerkamp, Chairman

The activities of the Publications Committee during the past fiscal year may be classified into three general

categories: (1) the development and publication of ILLUMINATING ENGINEERING; (2) the development, production, and distribution of special publications; (3) the production of preprints of conference papers. In carrying on this work, the Committee has functioned with three sub-committees: one on Editorial Content under the chairmanship of H. H. Magdsick; one on Advertising under the chairmanship of R. W. Staud; and one on Publications Sales under the chairmanship of R. W. McKinley. Through these subcommittees the advisory services of additional members have been available.

Under the enlarged publication program, ILLUMINATING ENGINEERING has included not only all of the regularly approved and recommended technical papers from the 1948 Conference in Boston, but also other papers, reports and articles of the so-called "popular type" covering topics of current importance and general interest.

As part of the added emphasis on the problems relating to practical lighting applications, lighting data sheets have been included as a regular feature since January 1949, in addition to other similar items. It is the plan also to include the Recommended Practices as they are developed and as many as possible of the officially recognized reports of the Technical Committees and reports of I.E.S. Research Projects. Of such reports, there have been published this year the following: Lighting for Wooden and Worsted Textile Mills; I.E.S. Guides to Testing Procedures; Lighting Equipment Engineering Data Sheet. Others are in process.

The advertising service feature of ILLUMINATING ENGINEERING under the new publication program is a most important one, and one to which the Publications Committee has given continuous attention. Although initiated under several handicaps which included a late start in the Fall of 1948, this phase of the publications program has developed quite substantially. In the nine issues of ILLUMINATING ENGINEERING, January through September inclusive, more than 200 pages of revenue advertising and 14 pages of Society advertising have appeared.

Special publications include such items as the *IES Lighting Handbook*, Lighting Data Sheets, Recommended Practices, and special reprints of papers, articles, and reports from ILLUMINATING ENGINEERING. Such material represents valuable data in the hands of the user, and the Committee has given special emphasis during the year to the widest possible dissemination of the Society's various publications.

Through new streamlined production procedures developed by the publications staff, and at the expense of some temporary disruption of the normal operations of the Publications Office, it was possible this year to have 23 of the 33 formal technical conference papers available in pamphlet preprint form for advance distribution to potential discussors early in August, more than a month in advance of the Conference. A total of 25 were available in printed form for use at the Conference. The special cooperation of the Papers Committee in limiting the length of acceptable manuscripts and in closely adhering to the established necessary deadlines materially facilitated the accomplishment of this objective.

IES Lighting Handbook

The fiscal year opened October 1 with some 623 copies of the first edition of the *IES Lighting Handbook* in stock. This was augmented shortly thereafter by a third printing of 2500 copies bringing the total stock to 3123 copies. Demand for the handbook has been consistently active all during the year, averaging some 200 a month for a total distribution of 1756 copies to June 30 in the fiscal year. The remaining stock of 1373 copies is expected to be adequate to meet the demand until such time as the second edition shall become available. In accordance with recommendations of the Publications Committee, as reported to Council at its April meeting in Chicago, preliminary action has been taken to provide for the preparation of a revised second edition.

ILLUMINATING ENGINEERING

Bringing to fruition the developmental plan of several years, the Society's official publication ILLUMINATING ENGINEERING entered upon a new era with the January, 1949 issue. The more significant changes included: (1) A liberalization of editorial policy to provide more effective service for the broad and diverse range of Society membership; (2) a change from the old 6 x 9 inch page size to an 8¼ x 11¼ inch page with corresponding changes in format and typography to provide for a more attractive presentation of both text and illustrative material; (3) an increase to 12 issues per year instead of the previous 10; and (4) the inclusion of a regular advertising section.

The objective of the enlarged program was to provide a monthly publication more broadly representative of both the science and art and the practical application of good lighting; also to reflect more adequately the Society's activities and other significant activities across the breadth of the lighting industry. Substantial progress towards these objectives can be reported, and the headquarters correspondence as well as membership reactions picked up by President Tayler in his official travels indicate that these initial efforts in the new program have met with wide membership approval. A continuation of the progressive development and improvement is the principal objective of the Publications Committee and the Publications staff.

Publications Policy

With the development of the publications program in ILLUMINATING ENGINEERING a number of basic policy decisions were made during the year.

TABLE IV—Illuminating Engineering-Transactions (6 x 9 Format)
Page Content by Sections 1944 through 1948

	1944-45	1945-46	1946-47	1947-48	Nov. & Dec. 1948
Technical Papers and Reports	809	740	803	952	293
Lighting News	151	165	136	151	23
Editorials	4	5	19	11	15
Solutions to Lighting Problems	7	3	....	....	....
It Seems to Me	10	15	....	....	....
Letters to the Editor	....	9	4	....	....
Modern Lighting Practice	18	14	....	....	....
Society Affairs	34	35	41	41	3
Miscellaneous Inserts	53	6	17	18	2
Current Articles on Lighting	....	52	32	30	4
List of Officers, Committees, Sustaining Members, Index	240	132	191	164	59
Total Pages Published	1,326	1,176	1,243	1,367	399

TABLE V — Illuminating Engineering-Transactions (8¼ x 11¼ Format)
Page Content by Subject Matter 1949
January to September

	Jan. to Sept. 1949
Technical Conference Papers	215
Technical Reports	91
Other Papers, Articles and Reports	88
Lighting Data Sheets	29
Editorials	4
Telecast including Current Articles, Letters to the Editor, Society Affairs, Current News, It Seems to Me	122
List of Officers, Committees, Sustaining Members	37
Advertising	226
Total Pages Published	812

After joint considerations with the Papers Committee and National Technical Conference Committee the following policy statement was recommended to Council and approved by Council at its December meeting:

"It is the policy of the Society that in general, papers accepted and approved by the Papers Committee for presentation at a National Technical Conference will be published in ILLUMINATING ENGINEERING in full or in condensed form with discussion in full or in condensed form when approved by the author, the discussor, and the Papers Committee."

Developing out of the above deliberations the committee submitted to Council at its February meeting the following statement of policy:

"It is the considered opinion of the Publications Committee that the interests of the Society will be served best if the Publications Committee is not required to publish such Technical and other reports in full in ILLUMINATING ENGINEERING, but exercise its discretion to require the preparation of digests for ILLUMINATING ENGINEERING, issuing the reports in separate form for individual sale. It is believed that the direction of effort in ILLUMINATING ENGINEERING should be the publication of digests of reports, except for a report that may be concise and of exceptional broad general interest, and that the responsibility of the preparation of such digests for ILLUMINATING ENGINEERING should rest between the office of the Technical Director and the initiating committee."

This statement was further discussed at the April meeting of Council and was approved together with a general re-statement of the guiding rules originally set down by the Task Committee on Editing the Society's new Journal, as follows:

1. Editorial content of Journal to follow outline approved by Council, April 1948.
   a. Current lighting installations and developments in materials and applications, presented in easily readable form to appeal to members and subscribers whose interest is not primarily technical. This includes present lighting data sheet material.
   b. Abstracts or summaries of technical papers subsequently to be available in full.
   c. Significant and timely items from the related sciences and arts, of both domestic and foreign origin.
   d. Basic technical information and advanced thinking for professional development in the field of illuminating engineering.
   e. National I.E.S. policies, programs, and activities, including committees—the Society's voice for interpretation, leadership.
   f. Editorials.
   g. News of Regional and Local activities and personalities.
   h. People significantly in the news.
   i. Expression of membership opinion through letters. Question and answer service.
   j. Transactions material — complete papers with discussion.
2. That in order to meet these objectives it may not be possible to publish Technical Committee reports in full in ILLUMINATING ENGINEERING within the current budget limitations.
3. Further, that the membership will be best served if some of the reports are published as digests.
4. That the Publications Committee feels technical reports are of value to the membership and deserve all possible space in ILLUMINATING ENGINEERING: that they should be printed in full in some form within the funds available.

General and Task Committees

Board of Nomination

A. F. Wakefield, Chairman

Operating under procedures specified in the Constitution and By-Laws the appointment of the Board was initiated at the October Council meeting by the selection of the three past-presidents and the chairman of the Board. The appointment of the representatives by the respective Sections was accomplished and the Board held its meeting for the slate of national officers in February. Extensive records of active members and previous officers of the Society were prepared and circulated to the whole Board for their study in connection with the selection of the slate.

Constitution and By-Laws

R. W. Corwin, Chairman

Developing out of the recommendation of the Finance Committee in connection with a possible increase in membership dues, Council took action to prepare an amendment to the Constitution and By-Laws eliminating the dues discount privilege. Upon referral to the Committee on Constitution and By-Laws this amendment was prepared as shown below and subsequently received favorable ballot by the membership.

"The annual dues for Associate Members shall be $11.00, for Members $13.00, and for Fellows $16.00, in each case being subject to a discount of $1.00 if payment is made within 60 days of the date of the bill. Annual dues for Student Members shall be $3.00. These dues shall include one subscription to the designated official publication of the Society" — by deleting the words, "in each case being subject to a discount of $1.00 if payment is made within 60 days of the date of the bill."

Historical

S. G. Hibben, Chairman

Arising out of the recommendation of the Project Planning Committee and developed through studies of the Task Committee under the chairmanship of S. G. Hibben the Historical Committee was appointed at the April Council meeting. The committee undertook as its general objective the assembly in suitable and durable form historical facts, photographs, voice records, and museum specimens as a representation of the Society's history. At the close of the year the committee had undertaken a review of records of all of the past conventions of the Society and the preparation of a number of permanent phonographic disks recording the voices of the available past-presidents of the Society.

Coordinating Committee for National Defense

A. F. Wakefield, G. D. Mills } Co-Chairmen

At the first meeting of the year, this committee decided to limit its contact

with Government agencies to strictly defense subjects something of the wartime order of "Does it shoot? Does it fly? Does it float?" — rather than jeopardize the reputation of the Society by promoting peacetime lighting needs of the various agencies of government.

The committee has recommended through Council, jointly with the Committee on Professional Requisites, a talent survey of Society membership. It has encouraged joint meetings at the Section and Chapter level with Posts of the Society of Military Affairs.

Two projects have been under consideration with engineering research and development laboratories of the Army, one of which is "classified." Two of our committee members are on the Sub-Committee on Illumination for the Armed Services NRC Vision Committee. While the activities have not been as great as anticipated in this field, it is considered that a service is rendered by those who stand ready to serve.

Lighting Service

J. M. Stedman, Chairman

The committee held three meetings during the year devoted primarily to the development of a Lighting Service Forum Program, held in connection with the Technical Conference at French Lick. The committee reviewed the Planned Lighting Awards in Industrial, Commercial, Residential and over-all classifications, sponsored by the Edison Electric Institute and the Better Light-Better Sight Bureau. The committee decided that in the portrayal of the educational programs and promotional activities set forth in the various sections of the country in the entries for these awards would be found the best in application of lighting on standards of the Society to people where they work, live and play.

Medal Award

A. F. Wakefield, Chairman

The 1949 Medal Award is announced under the section on Honors. The Award Committee this year operated under the newly adopted procedures approved by Council. Consideration was given to every candidate formally placed before the committee, and at a meeting, with all but one member in attendance, took unanimous action on the first ballot, which action was later supported by the absent member. A sub-committee was appointed to prepare the citation and the presentation of the Medal is scheduled at the Annual Conference.

National Technical Conference

R. F. Hartenstein, Chairman

At the November meeting of Council the committee reviewed the operation of the National Technical Conference at Boston and presented a final financial report indicating a surplus in the operation.

Following a review of the possible locations of the future National Technical Conferences the committee's recommendation was approved at the October Council meeting for the locations of the National Technical Conference in Pasadena 1950 and Washington, D. C., in 1951.

During the year the committee worked jointly with the Papers and Publications Committee in planning the production and publication of the technical papers to be presented at the French Lick Conference. This study was undertaken based on a statement of publications policy approved by Council at the December 1948 meeting as follows:

> It is the policy of the Society that in general, papers accepted and approved by the Papers Committee for presentation at a National Technical Conference will be published in ILLUMINATING ENGINEERING in full or in condensed form with discussion in full or in condensed form when approved by the author, the discussor, and the Papers Committee.

The committee also secured Council's approval on the general program for the French Lick Conference together with Council's approval of a budget for its operation. In connection with the above Council gave approval to the sale of sets of Conference Preprints at the French Lick National Technical Conference, this income to be credited toward the expense of the production of the preprints.

Acting on the recommendation of the Committee on Procedures and Policies the committee reviewed the Manual of Convention Procedure revising the statements of general policy and procedure and submitted this to Council for approval.

Conference Attendance During Last Ten Years

		Total
1940	Spring Lake, New Jersey	611
1941	Atlanta, Georgia	573
1942	St. Louis, Missouri (Two Day)	516
1943	New York, New York (One Day)	126
1944	Chicago, Illinois	721
1945	No Convention	.....
1946	Quebec, Quebec	807
1947	New Orleans, Louisiana	605
1948	Boston, Massachusetts	906
1949	French Lick, Indiana	668

Procedures and Policies

G. K. Hardacre, Chairman

Out of a very large number of matters considered, the committee has reported fifteen procedures and policies that have been accepted and approved by Council. In concluding the year's work, the committee gathered the procedures and policies formulated during the current year and several previous years into a completed "Manual of Procedures and Policies." This manual culminates a project that has long been needed and actively urged by the last six administrations.

Project Planning

J. S. Schuchert, Chairman

The committee made a number of recommendations to Council during the year, Council acting favorably in connection with all of them as follows:

Wider Distribution of Recommended Practices — That more effort be made of publicizing and distributing the Society's Recommended Practices.

Lighting Data Sheets — That wider publicity and sales effort be placed on the distribution of lighting data sheets.

Allocation of Funds for Technical Committee Field Work — That an amount should be budgeted each year for use by committees for field work if other resources are not available.

Historical Committee — That an Historical Committee be appointed to assist in the preparation of a celebration of the Society's Fiftieth Anniversary.

Advisory Committee to Assist the President — That an Advisory Committee be appointed to assist the President in the selection of committee personnel.

Technical Committee on Lighting of Central Station Properties — That a new technical committee be set up to study and report on the lighting of central station lighting properties.

Professional Requisites

R. L. Biesele, Jr., Chairman

This committee developed out of a Sub-Committee of the Lighting Educa-

tion Committee of the Society and was appointed at the February Council meeting to study and report on requisites for defining and improving the professional status of illuminating engineers especially in relation to Society membership. The committee presented two reports to Council at the June meeting outlining the general program contemplated on the basis of the committee's assignment and presenting a recommendation in connection with the adoption of the Canons of Ethics circulated by the Engineers Council for Professional Development. The committee's report was accepted and the matter of putting into effect the Canons of Ethics was referred back to the committee for recommendation as to the procedure for making binding on the membership.

Public Relations and Information

J. M. Hickerson, Chairman

The committee directed its efforts toward the two-fold objective of immediate action and long range planning. Suggestions were made in connection with the planning of a Society folder to be used by the Sustaining Membership Committee, and the revision of the Society Exhibit at the International Lighting Exposition. Means for better acquainting the membership and the lighting industry generally, with the aims and program of the Society were discussed. President Tayler contributed a great deal to this part of the program in his presentation with illustrative slides, at each of the Regional Conferences. As its final action of the year the committee submitted at the June Council meeting a long range program with definite recommendations.

Residence Lighting Forums

Priscilla Presbrey, Chairman

Two Residence Lighting Forums, of the New York Section and Michigan Section have been active throughout the year, New York having held eight meetings with an average attendance of 82, and Michigan five meetings with an average attendance of 43. In addition, the committee is happy to report the organization of a promising new Forum of the Georgia Section. The Philadelphia Section Forum has unfortunately been inactive during the past year. The New York Section Forum offered for the second year a five-session course on Practical Methods of Lighting Residential Interiors, aimed primarily at decorators and others with a professional interest in lighting, and attended by 69 registrants. This course has met with such success that New York University's Division of General Education has asked to take it over next year, and will present an eight-session course as a joint project, with the Forum planning the content and providing the lecturers.

The revised Guide for the Operation of Residence Lighting Forums, prepared by last year's committee, was duplicated and offered to the Sections and Chapters. The committee has tried to carry out its assignment to "reactivate and expand Residence Lighting Forums" by following up every known expression of interest. Considerable correspondence has been carried on with a number of Sections and Chapters, and with interested individuals. Letters are currently being addressed to each incoming Section and Chapter chairman, requesting that he include in the program of activities now being planned for the coming year a careful consideration of Forum possibilities in his area. The committee has planned a half-day Residence Lighting Forum Session for the 1949 National Technical Conference.

Sustaining Membership

George J. Taylor, Chairman

The work of the committee this year developed out of a special task committee appointed in July 1948 to put into action the recommendations of the Project Planning Committee to secure increased financial support from the Sustaining Members of the Society. A special letter, together with a review of the Society's accomplishments in 1947-48 were addressed to over 230 Sustaining Members of the Society. All of the Regional Vice-Presidents were added to the national committee, and a three-man committee was appointed by every Section and Chapter to carry on the committee's field work. With the cooperation of the committee notable results were achieved in the increase of financial support by 120 Sustaining Members giving the Society an increase of over $11,000 during the fiscal year. Some success was registered in the election of new Sustaining Members, although this part of the work was hampered by uncertain business conditions.

Number of Sustaining Members and Dues Income for Past Six Years

	Number of Members	Dues Income
1944	203	$18,916.00
1945	237	20,031.00
1946	265	21,881.00
1947	314	28,705.63
1948	326	30,209.37
1949	315	40,335.00

The committee prepared a statement of Procedures and Policies which after approval by the Procedures and Policies Committee was approved by Council as a guide in the election and maintenance of Sustaining Members. At the close of the year the committee had in preparation the material for a brochure to be used in future Sustaining Membership work.

Conference with the National Council for Schoolhouse Construction, Task Committee

Russell C. Putnam, Chairman

A member of the committee, Leland H. Brown, attended the annual convention of the National Council for Schoolhouse Construction in California last Fall on invitation. His presentation of the point of view of the Society in regard to school lighting and his explanation of the American Standard Practice for School Lighting contributed effectively to more complete cooperation between the two organizations. During the year additional contacts with members of the National Council for Schoolhouse Construction were made by correspondence and conference.

Joint I.E.S.-A.P.H.A. Task Committee

E. M. Strong, Chairman

Inquiry was sent in July 1948 to 34 physiologists, psychologists, ophthalmologists, engineers and others currently active in research concerned with the lighting field. These resulted in a dozen or more informative replies, suggesting research needs in lighting. These were organized and discussed by the committee. The result inspired plans for a symposium on lighting research needs which was arranged jointly with the Armed Forces-NRC Vision Committee and held at the National Academy of Sciences in Washington, February 19, 1949.

As an outcome of this successful conference plans are being made for a

similar symposium for the membership of the Society.

The committee currently is working on a survey of illumination standards for discussion at a future meeting.

Wartime Lighting Practices During World War II, Task Committee

O. P. Cleaver, Chairman

Originally appointed by President G. K. Hardaere in October 1946, this committee completed its task of assembly and correlating all existing material on lighting practice relating to World War II. The committee's report consisted of two parts:

I A condensed review of blackout and dimout procedures, practices and results, with interpretations for future planning, prepared by S. G. Hibben, Past Chairman, Committee on Defense.

II Bibliography of references on blackout, dimout, and civilian defense.

Copies of the report as approved by Council in June are being circulated to National Defense Agencies, and will be available for libraries and other interested agencies. The files of reference material and reports have been deposited at the Society Headquarters.

Technical Committees

Aviation Lighting

R. R. Brady, Chairman

During the current year two conferences and committee meetings were held — a three-day meeting at the Landing Aids Experimental Station in Arcata, California in November, and a two-day meeting in April, part of which was at the National Bureau of Standards in Washington, D. C. and the remainder at the Naval Air Test Center, Patuxent, Maryland. At the November meeting 34 members and guests were in attendance and at the April meeting 46 members and guests attended. At both meetings a number of papers covering various phases of aviation lighting were presented and at Arcata the committee saw the latest type of approach and runway lighting together with instrument landing systems in actual operation.

The status of the work of the various sub-committees is as follows:

Sub-Committee on Aviation Lamps — V. J. Roper, Chairman. The list of lamps covering recommendations for airport and aircraft lighting has been approved by Council and is now ready for publication.

Sub-Committee on Compendium — F. C. Breckenridge, Chairman. Considerable progress has been made by this committee during the year in that authors and reviewers have now been selected for all chapters on the Compendium with one exception. A Board of Editors has been appointed and approved by Council to act as reviewers and to edit the manuscripts. The Board Members are as follows: F. C. Breckenridge, W. E. K. Middleton, R. H. Blackwell, C. L. Crouch, and J. M. Waldram.

Sub-Committee on Airport Lighting — L. C. Vipond, Chairman. It was expected that "Recommended Practice for the Lighting of Small Airports" would be ready for Council approval by October 1st. However, due to the illness of the chairman, Mr. Vipond, the report, of necessity, has been delayed and it is hoped it will be ready before the end of the year.

Sub-Committee on Approach and Runway Lighting — G. M. Kevern, Chairman. No progress can be reported for this particular committee due to the fact that there is considerable controversy relative to approach lighting. Considerable work has been conducted by the Army-Navy-Civil Committee handling this activity but sufficient data are as yet unavailable to proceed with a recommended practice. In order to render assistance on the evaluation of approach lighting a task committee has been appointed to be known as Signal Visibility Task Committee whose duty it will be to review the paper "Standard Procedure for Calculating Effectiveness of Lighting Aids to Air Navigation" and report back to the main committee relative to the publication of this paper.

Sub-Committee on Aircraft Lighting — R. A. Rugge, Chairman. This committee is undertaking a particularly difficult task in attempting to issue a guide report on aircraft lighting. This is a time consuming task and it is estimated 40 per cent of the work has now been completed. It is hoped that this report will be ready for publication next year.

Sub-Committee on Taxiway Lighting — M. A. Warskow, Chairman. This committee has become quite active again feeling that further work should be done on the problem of taxiway lighting under conditions of low visibility. Such being the case, it has been recommended by the main committee through the chairman that a test program be set up to be carried out by the ANC committee at Arcata, California. In addition, the committee was assigned the task of investigating "The Application of Visual Aids to Airport Ground Traffic Control" and in this connection the chairman has forwarded to the ANC Visual Aids Committee for their consideration the committee's recommendation for work to be carried out.

Sub-Committee on Definitions and Terms —J. F. Angier, Chairman. Since the recommendations of this committee are tied in with and hinge upon the recommendations of ICAO (International Civil Aviation Organization) and since final decision on the revision of definitions and terms as well as nomenclature have been deferred time after time, this committee cannot complete their task and make their recommendations until ICAO's work is completed. It is now hoped this will be finished within the next year.

Sub-Committee on Lighting Study Projects — J. P. Hoxie, Chairman. One of the outstanding results of this committee has been the very valuable paper presented at the April meeting by Professor Blackwell "Report of Progress on the Roscommon Visibility Tests" parts of which were presented in June 1947 and in December 1948.

The chairman has been attempting to obtain safety reports from CAA for the purpose of studying the data on air accidents with the view of determining where such accidents can be attributed to faulty or misleading visual signals. These data have recently been received and a special committee will be appointed to pursue this investigation, reporting to the main committee through the chairman of the lighting study projects sub-committee.

Sub-Committee on Papers — R. E. Madigan, Chairman. During the past year three papers on aviation lighting have been printed by various trade journals and one of the papers presented in Boston at the Annual Technical Conference was printed in ILLUMINATING ENGINEERING. The papers presented at the April meeting are being reviewed.

This represents the final report of the chairman of this committee and he therefore wishes to officially thank the members of the Executive Committee and the sub-committee chairmen for their cooperation in carrying through the assignments of this committee.

Color and Illumination

Dean Farnsworth, Chairman

Three meetings of the committee have been held during the year — Sep-

tember 22 in Boston; October 22 in Detroit; March 8 in New York. The following wording of the objectives was adopted by the committee: "To study, evaluate and report on the effect of color in relation to illuminating engineering."

Methods of attacking the problem were discussed at all three meetings and by other informal conferences held before and since and by extensive correspondence. It appears that the field is much too large to be subsumed in any one report or series of reports in the foreseeable future. There even appeared to be insufficient foundation of common knowledge upon which to build a report. It became the general consensus of opinion that our primary attack should be: first, the mutual education of committee members themselves; second, the definition of the problems; and third, the gradual education of the members of the Society. In short, that a great deal would be accomplished by stimulating awareness of the problems by directing the attention of the membership to the complexities involved in the inter-relations of color and illumination.

A series of papers was projected, upon which each member of the committee best qualified in that field could work. Several members are actively working on their papers and whether these papers are published under the auspices of the committee or not they will represent a development of the program which has been outlined. In order to immediately bring the interrelationships of color and illumination to the attention of the membership as a whole, a Joint Symposium was arranged with the Inter-Society Color Council at the 1949 National Technical Conference.

Daylighting

W. C. Randall, Chairman

The Recommended Practice of Daylighting has been completed by the Sub-Committee and has been approved by letter ballot of the Daylighting Committee. It was recommended to Council at the June meeting and approved subject to letter ballot and editorial revisions based on comments received.

"Daylighting in Schools" is the title of a paper by Professor R. L. Biesele based on daylight research under his supervision, and is scheduled as part of the National Technical Conference at French Lick. Researches on daylighting at the University of Michigan and other locations are proceeding.

Farm Building and Work Area Lighting

O. D. Hunt, Chairman

Because of the wide geographic distribution of the committee, its work was carried on by correspondence. Two letters were circulated to the whole committee to assemble committee opinion on the program of work and to arrange assignment of the projects. As a result the committee has agreed on the form and outline to be included in the presentation of each lighting layout, as well as the complete outline of content for the proposed Recommended Practice of Lighting for Farmsteads.

Illumination Performance Recommendations

J. F. Parsons, Chairman

In collaboration with the Committee on Testing Procedures, the committee completed a suggested form for use as a guide by equipment manufacturers and testing agencies in the presentation of minimum photometric and other pertinent data on luminaires. This form was approved by Council at its April meeting.

The committee worked on the development of a Classification System for Luminaires in terms of the principal photometric characteristics of flux and brightness distribution. Work on this project is continuing.

In the development of Illumination Performance Recommendations for luminaires the committee continues to feel the lack of accepted basic data which would permit the rational establishment of performance recommendations based on limiting brightnesses required for visual performance and comfort. It is hoped that certain researches along this line now culminating will provide the facts necessary for setting up such recommendations.

Industrial Lighting

W. C. Brown, Chairman

The committee has been principally engaged in a revision of the American Recommended Practice of Industrial Lighting, 1942. The first draft of the proposed American Standard Practice for Industrial Lighting has been circulated to the members of the committee. The comments received from the members by correspondence indicate that the first draft is in the main satisfactory requiring only a few small editorial changes in order to be approved by the committee. However, the specific footcandle recommendations to be used for the various seeing tasks need to be considered carefully by the committee. These values are now under consideration.

Interior Lighting of Public Conveyances

E. W. Beggs, Chairman

Three meetings of the committee were held, in January, April and June, resulting in the following accomplishments: First and second draft prepared describing recommended operating circuits and auxiliaries for operating fluorescent lamps on — Steam and electric railroads; Electric traction (surface cars, subways, elevated railways and trolley coaches); Motor coach; Marine (ferry boats, passenger ships).

Preliminary study begun of illumination requirements — level distribution, maintenance, etc.

Committee effort is continuing toward the objective of a handbook of recommended practice.

Library Lighting

J. M. Ketch, Chairman

The final report of the Library Lighting Committee was presented to Council at the June meeting. Several suggestions were made by Council Members in regard to statements in the body of the report and as to the changing of two sections of the appendix which are related to the report as a recommended practice. These changes are being made and the report is scheduled for circulation to Council members for letter ballot.

Lighting and Architecture

H. E. D'Andrade, Chairman

The committee's assignments for the year included:

To foster an Architectural Competition among universities.

To arrange for reinstatement of a Light and Architectural Photographic Series for ILLUMINATING ENGINEERING.

To prepare a Lighting Handbook for Architects.

The first activity, namely, Architectural Competition, has been aided by

the Local Activities Committee through the distribution to all Sections and Chapters of a circular letter urging such competitions and outlining suggested procedures.

The committee has in process the collection of photographs for a Light and Architectural Series. However it finds that this activity largely duplicates the material now presented in the lighting data sheets and recommends that these activities be merged.

The committee is now collecting material, much of which has been written by members of the committee at various times for Society papers and magazines, which can be used in the Lighting Handbook for Architects.

Light Control and Equipment Design

F. C. Winkler, Chairman

The assignment of duties of this committee includes:

1. To prepare a manual containing useful design data for various materials, surfaces and contours; include descriptive material on devices for determining light control of curved surfaces.
2. Review for revision that section of the Handbook pertaining to Light Control.

The first two meetings of the committee were devoted to an analysis of the committee's assignments and a division among the committee of the tasks to be done.

The committee has gathered together considerable reference data which includes the report made by the Committee on Diffusing Materials of the Society, a copy of the book "Theory and Design of Illuminating Engineering Equipment," co-authored by Mr. J. M. Waldram; numerous references such as "Notes on Lighting Fundamentals," "Experiments with Light," "Thickness Control of Sharp Cut-Off Types of Glasses," "Engineering Aspects of Direct Lighting Part II," "Electrical Illumination," and many others. The committee is also studying the Research Report No. 46B85 by the Detroit Edison Company covering design and construction of an improved light control panel.

Included in the conclusions already reached by the committee is the belief that the committee's assignment is too large and involves considerable more work than is possible for any one committee to complete in a year's time.

Lighting Design Practice

C. L. Amick, Chairman

In response to a specific assignment, the Committee on Lighting Design Practice prepared and presented to Council a report recommending uniform methods for computing and presenting Room Indexes, Coefficients of Utilization and Maintenance Factors. The committee also reviewed for revision Section 8 of the IES Lighting Handbook, and instituted nine projects to improve the information on lighting calculations. Continued study of these and additional projects has been suggested for 1949-1950.

Lighting Education

C. D. Miller, Chairman

The committee has publicized the "Lighting Fundamentals" course to the membership, stressing the merit in using material prepared by Society committees. The "Lighting Design Problems" course was also brought to the attention of the membership, emphasizing its value as a follow-up after completing the Fundamentals Course. Some preliminary work was done on the assignment of developing an Advanced Course but before progressing further, it was deemed advisable to survey and study all existing publications to determine the feasibility of incorporating certain of these into a booklet or kit suitable for use as text material in an Advanced Illumination Course.

A great deal of valuable reference material has been developed by committees of the Society but very little is actually used by the members. To encourage the use of the material available from headquarters, the Education Committee recommends frequent publication of the list in ILLUMINATING ENGINEERING and letters to local committee chairmen suggesting ways and means of utilizing the material in their section or chapter programs. As one solution to the other assignment of assembling and maintaining an up-to-date list of lighting reference material, the committee suggests making reprints of the references shown at the end of each section of the IES Lighting Handbook. This would provide a more complete and comprehensive list of lighting references than could be assembled by any other means and at a minimum cost.

The committee has under consideration sending questionnaires to colleges and universities requesting information as to whether courses in Illumination are available to their students, and if so, what subjects are included. Such data should prove to be of interest and undoubtedly would reveal the need for a wider acceptance and inclusion of illumination courses in the curriculum of engineering schools.

Lighting of Central Station Properties

A. A. Brainerd, Chairman

Since the formation of this committee in February two meetings have been held. The most recent being a two-day session in Philadelphia on June 28 and 29. Preliminary reports are being prepared by five sub-committees as follows:

1. Lighting of Control Rooms
2. Lighting of High Bay Areas
3. Exterior Illumination
4. Lighting of Irregular and Miscellaneous Areas
5. Lighting of Load Dispatch Rooms and Telephone Switchboards

Lighting Study Projects in Educational Institutions

R. C. Putnam, Chairman

The committee reviewed the seeing and lighting problems in educational institutions and selected five fields for the first study projects. Study committees in each of these fields were organized during the year. The subjects of the individual study committees are: Student Vision and Scholarship; Visual Problems; Brightness Conditions in Educational Environments; Utilization and Control of Daylight; Chalkboards.

The projects of these committees are basic in nature and long range in scope. Work is proceeding actively in all fields and valuable fundamental data should result.

Lighting Study Projects in Industry

M. N. Waterman, Chairman

The General Committee had two regular meetings, plus a partial meeting with members of the Committee on Lighting in Woolen and Worsted Mills. The principal accomplishments for the year included:

Completion of review of Woolen Report which was approved by Council in October.

Review of Steel Mill and Canning Reports submitted during the year.

Completion of instructions to project committees as to procedures for preparation and submission of project reports. Completion of a suggested form of project report for guidance of field committees.

Progress on individual projects is reported as follows:

Bakeries — Second draft of committee report submitted in June now being duplicated and made ready for review by the "General" Committee.

Canning — Report on general lighting and three supplementary reports approved in principle by Council in April. Combined version of these reports is passing through final revisions, preparatory to letter ballot by Council.

Flour Mills — Report approved last year has been edited by the Technical Director's office preparatory to publication.

Fluid Milk — Chairman is continuing negotiations toward resumption of work on this project.

Foundries — Partial first draft of report completed in May.

Laundries — Field work completed in March. Committee now engaged in drafting report.

Leather — Field work completed. First draft of report now being prepared.

Machining of Small Metal Parts — Report, approved last year, is now ready for final checking before publication.

Printing—Initial field tests commenced in a Washington printing establishment in February.

Sheet Metal Stamping — Several meetings held during the year to determine procedure, and to organize experimental installations for the purpose of studying brightness of dies as viewed by the operator.

Steel — Report on Lighting of Open Hearth Areas approved by Council in June subject to letter ballot. Editorial and other minor changes now being negotiated prior to the ballot.

Supplementary Lighting — Outline of procedure under a somewhat enlarged scope was submitted and endorsed by "General" Committee in February.

Textile-Wool — Committee report approved by Council in October and published in June issue of ILLUMINATING ENGINEERING. Committee has continued its work on additional data sheets.

Tobacco — Committee still in process of reorganization.

Lighting Study Projects in Public Buildings and Private Institutions

Robert R. Wylie, Chairman

The work of this Committee has been carried on by four study subcommittees investigating the problems of lighting auditoriums and churches, hospitals, hotels and theatres. The Hospital Lighting Committee is studying the lighting problems in every part of a hospital and has in preparation a comprehensive report. The Theatre Lighting Committee is studying the special lighting problems encountered in theatres and motion picture houses including consideration of relative screen brightness. The Hotel Lighting Committee is concentrating its first studies on the lighting problems in guest rooms with the design of bed and bathroom mirror lighting for these rooms.

Light Sources

A. B. Oday, Chairman

The main objective of the committee this year has been largely one of exploration in order to determine what things the committee could do and how they could function most effectively in order to best serve the Society as a whole. Our conclusions to date indicate a number of quite important subjects pertaining to light sources on which there are little or no adequate practical data. There are listed below a number of topics or subjects that we have discussed this year which we believe should be submitted to Council for consideration and possible assignment in order to insure that the necessary data will be forthcoming. The subjects that appear most important for the time being are the following:

A Satisfactory Method of Specifying Color of Fluorescent Lamps — There is an urgent need in the industry for a satisfactory method of specifying the color of fluorescent lamps. It was felt that the present method, which is tied in with the I.C.I. tricoordinate system, is not entirely satisfactory. Another method which recognizes the discrepancy between the spectral energy distribution of a fluorescent lamp and that of an incandescent or blackbody source should be devised.

Effect of Wave Form on Lamp Performance — The purpose of this suggested study would be to determine the effect of the current or voltage wave form supplied by the auxiliary equipment on the performance of fluorescent lamps, as well as all other types of electric discharge lamps. Primarily, this study would be involved with the effect of wave form on the light output of these various lamps.

Fundamentals of Lamp Starting — It was suggested that the committee promote a study leading to a thorough understanding of the phenomena involved in initiating the discharge in all types of gas discharge lamps. This study would include a thorough survey of the literature and a correlation of all this information in a single report.

Effect of Temperature on Lamp Performance — A better knowledge of the effect of both high and low ambient temperature on the various lamp parameters, such as, starting, light output and lumen maintenance, is much to be desired.

Performance and Characteristics of Integral Reflector Type Lamps — The increasing interest in the applications of lamps embodying an integral reflector, makes a report on this subject of timely interest.

Miscellaneous Problems — Other problems, such as, standard lamps, standard ballasts, etc., need to be better specified but are being handled by other organizations such as the A.S.A. This committee simply desires to point out the need for this information for standardization.

It is suggested that an analysis be made to ascertain whether other committees are doing work belonging to the Light Source Committee. For example, testing procedures for light sources is probably a project which should properly belong to the Light Source Committee.

Nomenclature

A. E. Parker, Chairman

This year's activities developed out of joint deliberations of a Sub-Committee of this Committee with a Sub-Committee of the Optical Society of America. After considerable discussion agreement was reached on various definitions and these were then submitted to all members of the Committee on Nomenclature and favorably approved with two exceptions. The material for the revision was finally organized and presented to Council at its December meeting. Council requested certain action at that time be taken by the chairman of the committee to ascertain more fully the sentiments of the committee and this was done and reported to the February meeting of Council.

Office Lighting

R. L. Oetting, Chairman

Under the sponsorship of the committee, six Project Committees have been established to evaluate present data and to develop further knowledge in support of the Society's recommendations on Office Lighting. The areas of activity include:

The visibility of representative office tasks.

The distribution of brightness and illumination developed by artificial lighting systems and by various types of day lighting techniques.

Determine proper reflectance values for all surfaces and survey the finishes actually provided by manufacturers.

Determine the rate of depreciation for individual components and for complete office environment with representative lighting systems.

Survey the recommendations of others involving related factors such as color, color combinations, window-less environment, pictorial displays, etc.

Determine the seeing requirements and lighting for specific types of office space or operation.

Residence Lighting

E. W. Commery, Chairman

Five papers have been prepared for presentation in a half-day technical session of the National Technical Conference. Eight members of the committee, working alone or in partnership with other members, have prepared this material. Subjects included are the lighting for hand sewing, color, piano music, laundry work, and television as found in the home.

Moderate progress has been made in the preparation of a booklet to set forth the techniques and materials to be used in introducing present-day lighting standards in period interiors. The Sub-Committee is titled "Contemporary Lighting Practice in Modern and Traditional Homes" with Miss Myrtle Fahsbender as Chairman.

Accomplishment—The Chairman has now developed all of the necessary data and outline copy for a revision of Appendix B of the "Lighting Performance Recommendations for Portable Lamps and Installed Residence Luminaires" to indicate the locations of the areas that are to be specifically illuminated for each of the visual tasks found in the home. The list was not complete or fully developed when this first edition of the "Recommended Practice" was published in July 1946. Since that date more specific test procedures and illumination test-plane locations have been developed which have revealed the inadequacies and errors in the present publication. A new and complete rehandling of this material, properly illustrated, is needed for not only the manufacturer but also the lighting specialist and practitioner.

In addition, art work has been developed for each of ten visual problems. Seventeen illustrations with the associated data have been approved by the committee. Finished art work and finished copy with final refinements remain to be done.

Mr. Norman Vacha was appointed the Sub-Committee Chairman to determine how the Society can be of greater benefit to the residential fixture manufacturers that are Sustaining Members. From correspondence surveys carried on, it is evident that much clarification of the objectives of the Society's aims and endeavors need to be attempted. Further studies of the methods of evaluating discomfort glare when viewing residential fixtures show the need for further fundamental research. The committee voted to have a recommendation prepared and forwarded to the I.E.S. Research Fund asking that this subject be considered for further study. An adequate report on the problem is being prepared by the Chairman.

Mr. T. S. Kelly was appointed Sub-Committee Chairman to survey projects for Undergraduate Study. Mr. Kelly prepared a questionnaire and sent it to a large number of university and college heads, including all of those members of the Society associated with educational institutions. His report shows a rather universal misunderstanding of the questions being asked.

Miss M. E. Dodds was Chairman of a Sub-Committee to make Studies to reveal the lighting and viewing habits of families owning television receivers. While studies of how this project should be undertaken have been carried on and several methods proposed, no real full-scale work has begun.

Sports and Recreational Area Lighting

B. S. Benson, Chairman

The committee organized its program around the assignments set forth by the President, as follows:

1. Report on gymnasium lighting.
2. Establish study projects in the various fields of sports lighting with the object of determining footcandle requirements on the basis of player and spectator need and report thereon.
3. Prepare a recommended practice on the application of light and lighting to the areas and activities involved in sports and recreation.
4. Review for revision of the Handbook that section pertaining to sports lighting.

Various sections of the field were assigned to task sub-committees and a uniform outline of content of each report was agreed upon. During the year the committee discussed, by correspondence, at some length whether it was ready to report on current lighting practices in its field, or whether instead it should first make a number of studies of lighting requirements.

Standards of Quality and Quantity for Interior Illumination

L. E. Barbrow, Chairman

The committee has collected data of three types on illumination as a function of task; the first type is based on performance (speed and accuracy), the second on visual acuity, and the third on the visibility meter. An effort is now being made to reconcile the results yielded by the three methods so that the committee report on this subject may be of maximum benefit to our members.

Store Lighting

M. W. Ross, Chairman

The aim of the committee this year has been to give publicity to the report published the previous year, "Lighting Practices for Stores and Other Merchandising Areas," and to call attention to the principles brought out in that publication. This was done through articles in ILLUMINATING ENGINEERING and other magazines and through assistance to the editorial staffs of such magazines in the preparation of articles on store lighting.

Street and Highway Lighting

Stuart R. Williams, Chairman

The committee reports substantial progress on a number of the long term assignments undertaken. A two-day Spring meeting was held in Cleveland, Ohio.

The Sub-Committee on Pavement Surfaces and Safety Lighting under the chairmanship of Mr. F. D. Wyatt has underway an important research project. The Trustees of the I.E.S. Research Fund voted assistance and a contract was signed with the University of Illinois. This research will provide the committee with fundamental data on reflectance characteristics of several types of pavement surfaces under various conditions and with varying angles of incidence of light. The Sub-Committee, in addition to this work, is simultaneously carrying on individual studies — and is in close collaboration with The Asphalt Institute, Portland Cement Association, Institute of Traffic Engineers, and other groups interested in this subject.

The Sub-Committee on Coordination, H. F. Ilgner, Chairman, has been very active with the Highway Research Board, National Safety Council, Institute of Traffic Engineers.

Another important accomplishment was the formation of a Sub-Committee on Local Study Assignments in Accident Surveys with R. E. Simpson as Chairman. This is a large Sub-Committee with wide geographic distribution and will undertake to compile complete accident data on an exactly comparable basis.

The Sub-Committee on Studies for Revision of the American Practice has been continually accumulating and correlating data. A substantial share of the time of the full committee was devoted to this subject at the Spring meeting.

The Research Sub-Committee with Kirk M. Reid as Chairman undertook additional field studies on Discomfort Glare but the investigations are not yet complete and ready for release. As previously reported the Sub-Committee has requested I.E.S. Research Fund support for two fundamental studies involving criteria of visibility appropriate to street traffic and studies of veiling glare as found in street lighting. Qualified laboratories available for these researches have not yet been located but the subject is being continually followed.

Dr. R. M. Zabel, Vice-Chairman of the committee was the Society's representative on the Engineering Committee of President Truman's Highway Safety Conference.

The special task committee with the late Preston S. Millar as Chairman reviewed the committee's 1927 Report on Principles of Street Lighting. A complete analysis was made of weight to be given the many factors affecting street lighting installation in an effort to approach an arithmetical value for each for expert visual appraisal. This table has been completed.

Testing Procedures for Illumination Characteristics

Ray P. Teele, Chairman

The committee had five projects under consideration during the year:

Prepare a guide for field measurements of floodlighting and report thereon.

Prepare a guide for field measurements of street and highway lighting and report thereon.

Review for revision report on photometric testing of floodlights and narrow beam projectors.

Review for revision report on photoelectric photometers and report thereon.

Review for revision that section of the IES Lighting Handbook pertaining to testing procedures.

The first two projects had so much in common that it was deemed advisable to combine them in a single guide. The result entitled, "I.E.S. Guide for Outdoor Illumination Tests — Part I — Street and Highway Lighting; Part II — Baseball and Football Fields (Other Sports Areas)" was completed and submitted to Council at its June meeting. Council accepted the report for letter ballot subject to concurrence by the Chairman of the Committee on Sports and Recreational Area Lighting. The Chairman of the Committee on Street and Highway Lighting had concurred prior to the June meeting.

The last three projects listed have been discussed briefly at committee meetings. The revision of the report on photometric testing of floodlights and narrow beam projectors was discussed at a committee meeting in July, and an outline for the first draft prepared. A task force is preparing the draft.

The remaining two projects are being carried forward and with the revision of the Handbook Section on Testing Procedures are top priority activities.

TELECAST

LIGHTING NEWS OF CURRENT INTEREST

Summary of Action Taken By Council Executive Committee

A number of matters of interest to the Society's work were discussed at the regular bi-monthly meeting of the Council Executive Committee, held in New York on November 9. President Charles H. Goddard presided, with the following also in attendance: Vice-Presidents S. G. Hibben and Walter Sturrock; Treasurer, E. M. Strong; General Secretary, A. H. Manwaring; Executive Secretary, A. D. Hinckley; Technical Director, C. L. Crouch; Director of Publications, G. Ross Henninger; and B. J. Benson, Chairman Handbook Revision Committee.

Among other discussions was one on the procedures followed in the election of qualifying members to the grade of Members Emeritus. To establish a definite guide to the General Board of Examiners for recommendations to this honor, Vice-President Hibben and the Board of Examiners were asked to undertake a study of the matter.

Membership Statistics

The General Board of Examiners in their report gave the following membership totals, shown in comparison with the previous figures:

Sept. 30 1949		Nov. 9 1949
6,883	Total Membership	6,913
26	Members Emeritus	26
44	Fellows	45
1,521	Members	1,535
5,048	Associate Members	5,064
244	Student Members	243

Sustaining Members

The committee acted favorably on the election of one additional Sustaining Member, reported by George J. Taylor, Chairman of the Sustaining Membership Committee. Elected was:

The Home Gas and Electric Co.
810 Ninth Street
Greeley, Colorado
Official Representative,
C. Gilbert Dressor

Local I.E.S. Contests

In his report on Local Activities, Vice-President S. G. Hibben outlined plans submitted by the Pittsburgh Section and the Central New York Chapter for projected contests to be conducted by their groups on "My Most Interesting Lighting Installation." Executive Committee approval is in order for such local projects, and in the cases presented the committee approved these special activities with the provision that locally available funds will be used for any cash awards.

Committee Appointments

A number of committee appointments were approved by the committee, for both new committees and personnel of existing committees. In the back pages of this issue of Illuminating Engineering, complete committee listings to date are given, together with Local Representatives, Official Representatives, etc. Any later appointments will be published as corrected listings when the committee lists are printed in a later issue.

Philadelphia Set for 1950 Regional Conference

Although no official word has been received at headquarters, it is understood by grapevine reports as this issue goes to press that the Philadelphia Section is all set to serve as host for the 1950 Conference of the East Central Region. It seems that rather detailed plans were completed by the responsible Committee at a meeting recently held in Harrisburg.

It is understood that the two-day Conference will be held May 18-19, 1950, at the Warwick Hotel in Philadelphia. It is reported that this hotel is completely air-conditioned and affords an ideal location for the Conference. Preliminary plans for the program have been drawn up, and the Committee is actively working on the remaining final details.

Secretary for the Conference Committee will be P. B. Thorne, General Electric Co., 1405 Locust St., Philadelphia 2, Pa.

Survey Made on Ads Outside Lighting Industry Featuring Better Seeing

People within the lighting industry have noticed for some time that manufacturers of products in no way connected with lighting frequently feature the "better seeing" appeal in their magazine advertising.

To determine to what extent this was the practice with manufacturers outside the lighting industry, the F. W. Wakefield Brass Co., Vermilion, Ohio, conducted an informal survey of business and trade paper advertising over a period of six months in mid-1949. They scanned for ads, not connected with lighting, featuring no-glare surfaces to reduce eye strain when using the product or reflectant non-glaring surfaces which do not unduly absorb light, thereby wasting it.

It was concluded from the study that manufacturers in widely varying fields are becoming increasingly conscious of discomfort, loss of efficiency, in general the high cost of glare in business. Their advertising indicates also that surfaces which absorb light do not reflect to the owner all the light he pays for, and are therefore poor investments.

During the investigation 51 advertisements cropped up which were definitely based upon absence of glare or good reflectance without glare. Sixteen were in the field of paint and cement; 5, business machines; 7, furniture (office or comparable); 6, glass

block or tile; 3, tools; 3, chalk boards for schools; 4, partitions; 3, paper where glare is probably most apparent; 2, automotive; and 2, miscellaneous.

Of these, 25 were in terms of glare reduction, 17 featured proper reflectivity of light from the surface, and 7 were in general terms of better seeing because of the surfaces on the products advertised.

The Wakefield Co. felt the results to be indicative that a growing awareness of the principles of lighting and seeing is spreading beyond the manufacturers of lighting equipment.

Light Meters for Umpires?

One source of baseball rhubarbs will be eliminated if Commissioner Chandler acts favorably on a proposition placed before him by a Boston fan. This is that plate umpires use light meters in making their decision to halt games. Furthermore, General Electric has offered to make available technicians and equipment to demonstrate to baseball magnates the feasibility of setting up uniform light levels to guide the umps in calling games for darkness, or even for turning on the lights.

The plate umpire's judgment, with no yardstick to guide him, has been questioned (but good) many a time. The Boston fan's letter to Chandler was prompted by a July 10 game at Boston between the Red Sox and the Philadelphia Athletics. Cal Hubbard, plate umpire, called the game in the seventh with the A's trailing 11 to 10, but rallying. Philadelphia disagreed—eloquently and at length—and Connie Mack filed a protest.

To demonstrate how uniform standards could be established, the offer has been made to send engineers and equipment to the annual convention of the National Association of Professional Baseball Leagues at Baltimore December 7-9, and the major leagues meeting in New York December 12-14.

Planning Kit Available for Lighting Layouts

A planning kit designed to simplify the preparation of pattern layouts for modular installations has recently been made available. The kit may be obtained without charge on written request to the Mitchell Manufacturing Co., 2525 Clybourn Ave., Chicago, Illinois.

Included in the kit are Room Index and footcandle Calculation Factor tables, from which the proper number of modular units may be calculated for a given installation. A transparent scale rule with cutout templates for $\frac{1}{8}$" and $\frac{1}{4}$" scales, and three planning grid sheets are enclosed with the kit for tracing installation patterns on blueprints of floor plans.

LIGHTING CALENDAR

Society Events

December 8, 1949 — Meeting of I.E.S. National Council, New York, N. Y.

February 8, 1950 — Meeting of I.E.S. National Council, New York, N. Y.

February 26-28, 1950 — Southwestern Regional Conference, Dallas, Texas.

March, 1950—Southern Regional Conference, Atlanta, Ga.

April 6, 1950 — Meeting of I.E.S. Council, Edgewater Beach Hotel, Chicago, Ill.

May 8-9, 1950 — Great Lakes Regional Conference, Buffalo, N. Y.

May 11-12, 1950 — Canadian Regional Conference, Montreal, Que., Canada.

May 18-19, 1950—East Central Regional Conference, Philadelphia, Pa.

May, 1950—Midwestern Regional Conference, Milwaukee, Wisconsin.

June 7, 1950 — Meeting of I.E.S. National Council, New York, N. Y.

August 21-25, 1950 — Southern California National Technical Conference, Pasadena, Calif.

Industry Events

December 4-7, 1950 — The American Society of Refrigerating Engineers, 45th Annual Meeting, Edgewater Beach Hotel, Chicago, Ill.

December 26-31, 1949 — The American Association for the Advancement of Science, 116th Meeting, Statler Hotel, New York, N. Y.

January 14, 1950 — Independent Electrical Contractors Association, Inc., Annual Dinner and Dance, Hotel Astor, New York, N. Y.

January 16-19, 1950—Plant Maintenance Show, Auditorium, Cleveland, Ohio.

January 23-27, 1950—American Society of Heating and Ventilating Engineers, Annual Meeting, Dallas, Texas.

January 23-27, 1950 — New York Lamp Show, Hotel New Yorker, New York, N. Y.

January 30 - February 3, 1950 — American Institute of Electrical Engineers, Winter General Meeting, New York, N. Y.

February 6, 13, 20, 27, March 6, 13, 20, 27, 1950 — Essex Electrical League, 5th Annual Light and Power Conference, Public Service Building, Newark, N. J.

February 27 - March 3, 1950—American Society for Testing Materials, Committee Week and Spring Meeting, Hotel William Penn, Pittsburgh, Pa.

March 3, 1950—Association of Electrical Construction Engineers, Annual Meeting, 2 Park Ave., New York, N. Y.

March 7-10, 1950 — Essex Electrical League, 6th Annual Electrical Industrial Exposition, Newark, N. J.

March 13-16, 1950—National Electrical Manufacturers Association, Edgewater Beach Hotel, Chicago, Ill.

March 28-31, 1950 — Greater New York Safety Council, 20th Annual Safety Convention and Exposition, Hotels Statler and Governor Clinton, New York, N. Y.

April 4-6, 1950 — Edison Electrical Institute, 16th Annual Sales Conference, Edgewater Beach Hotel, Chicago, Ill.

April 19-22, 1950—The Electrochemical Society, Ninety-seventh Convention, Statler Hotel, Cleveland, Ohio.

June 6-8, 1950 — Edison Electrical Institute, 18th Annual Convention, Atlantic City, N. J.

June 12-16, 1950 — American Institute of Electric Engineers, Summer General Meeting, Pasadena, Calif.

June 12-16, 1950—National Association of Electrical Distributors, Atlantic City, N. J.

June 19-21, 1950—American Society of Heating and Ventilating Engineers, Semi-Annual Meeting, Muskoka Lakes, Ont., Canada.

Committee on Aviation Lighting Holds Two-Day Conference at Indianapolis

For the purpose of hearing and discussing a series of technical papers dealing with important phases of aviation lighting, and also for the conduct of routine official business of the Committee, the Committee on Aviation Lighting held a two-day conference in Indianapolis on October 24-25. The Civil Aeronautics Authority played host for the occasion, and meetings were held at the CAA Experimental Station at Weir Cook Municipal Airport. The registered attendance was 33. The new Chairman of the Committee, L. B. Moore of Urbana, Ohio, presided.

After a day spent in the presentation and discussion of technical papers, Monday evening was given over to a demonstration and inspection of the facilities of the CAA Experimental Station, including all of the latest types of lighting and electronic landing and navigational aids equipment that has been installed there for service testing. This phase of the program was under the direction of H. J. Cory Pearson, Chief of the CAA Lighting Branch. It included not only a visit to the control tower where the operations of a busy airport could be observed under normal night operation, but also a series of test flights which enabled all of those present to see for themselves from the pilot's viewpoint just how the landing-aid light signals, including the new Slope-line System, function to guide an aircraft in to a smooth landing on the runway.

Principal feature of the second day's session was the long-awaited detailed report on an evaluation of the comparative experimental testing of "soupy-weather" landing aid at the Landing Aids Experiment Station at Arcata, California. The Committee's business session was held Tuesday afternoon.

Plans were laid for an aviation session at the I.E.S. 1950 National Technical Conference at Pasadena, California. Plans also were made for an executive committee meeting to be held at I.E.S. Headquarters in New York City December 9, and a general committee conference at Washington, D. C., next spring.

Program of Technical Papers

The following technical papers were presented and discussed:

1. "Aviation Colour Signal Lights" by John G. Holmes, Holophane, Ltd., England; presented by Dr. Breckenridge of the Bureau of Standards in Mr. Holmes' absence.

2. "Some Considerations Underlying the Specifications of Signal Lights" by F. C. Breckenridge, National Bureau of Standards, Washington, D. C.

3. "The ANDB (Air Navigation Development Board) Program for Development of Electronic and Visual Aids for Surface Traffic Control," Captain Wilson P. Cogswell, Navy Member of ANDB, Washington, D. C.

4. "Status and Problems of Transport Aircraft Position Lighting," Harold F. Tanke, Airframe & Equipment Branch, CAA, Washington, D. C.

5. "A Discussion of Flight Conditions Affecting Airport Traffic," Marcus S. Gilbert, Airport Lighting Engineer, CAA Experimental Station, Indianapolis, Ind.

6. "Recent Developments in Low Approach and Landing Aids for Aircraft" (Report on Arcata Experiment), Dr. Maurice A. Garbell, Aeronautical Engineering Consultant, San Francisco, Calif.

Some insight into the scope, nature, and significance of these various subjects may be gained from the following digest:

Coordinated Specifications for Signal-Light Colors

Mr. Holmes' paper was presented by Dr. Breckenridge of the U. S. Bureau of Standards. Mr. Holmes stated that one of the most valuable practical results of the adoption of the I.C.I. Trichomatic System in 1931 was the uniformity which developed in methods of specifying color tolerances for light signals, but stated that this has not been followed by a corresponding uniformity between the specifications themselves. The different sets of tolerances recommended by the I.C.I. in 1935 for international adoption covering airdrome lighting, airplane lighting, road traffic signals, and railway signals were cited as examples. Mr. Holmes stated that "it would seem likely that the requirements on any one type of light signal are the same in all countries, and that there would be some definite advantage to be gained from comparing the practical experiences and in attempting to find the reasons for differences existing between different countries." Also there are differences for different types of signal in the same country.

It was reported that recently fundamental work on the recognition of colored signals has been done by several experimenters and, in Great Britain a single specification (B.S. 1376: 1947) has been prepared to include several types of signal.

Mr. Holmes discusses the basis of color specification in terms of the requirements to be met and the method of describing the limits, compares recent sets of tolerances in diagrammatic form and describes the fundamental work on color recognition which led to the development in Great Britain. He recommends that the National Committee of other countries should be invited to submit other fundamental data and results of practical experience, and that an I.C.I. study committee should prepare a review and explore the possibilities of co-ordination to remove insignificant differences and to obtain the optimum demarcation between colors used for signal purposes. (Mr. Holmes' paper was published originally as an appendix of the 1948 I.C.I. Proceedings under the title "Co-ordinated Specification for the Colours of Light Signals."

In presenting his own comments under the title "Some Considerations Underlying the Specification on Signal Lights," Dr. Breckenridge's stated basic objective is the development of practical tolerances in the specification of colors for signal purposes. He mentioned three basic determining factors: the need for a better color diagram; the practicability of producing and maintaining a signal; the problems involved in specification enforcement.

He urged that a serious effort should be made to establish a more practical representation of color data for specification purposes than is afforded by the I.C.I. diagram, concerning which he stated that the major criticism is that the minimum perceptible changes in color represent widely varying and non-comparable scale differences on the I.C.I. diagram

depending upon the specific color under consideration. He urged that since the prime purpose of plotting color characteristics in the form of a diagram is to assist the mind of the observer to visualize the relationship existing between different visual colors and the elements of which they are constituted, it was Dr. Breckenridge's opinion that the non-uniformity of the scale distances representing different colors on the I.C.I. diagram defeat in large measure the basic purpose of the diagram. As one means of overcoming the defect, he explained the use of a "rectangular-uniform-chromaticity-scale co-ordinate system" which result in a color-mixture diagram which gives more nearly equal scale representations for variation in color regardless of the specific color that may be under consideration at any particular moment.

In discussing the practical side of the problem of producing and maintaining a given desired signal color—from the viewpoint of accurate identification by the observer—Dr. Breckenridge mentioned several factors. One was that the varying thickness of lens or color filters, although of identical material, produces different color effects. Another factor is the difference in color-temperature of different light sources, which will give differences in visual color effects. For example, the light sources used behind color-signal glassware range from the kerosene flame (1900°K) to the incandescent lamp (as high as 3250°K). A third factor is the effect introduced by changes in operating temperature of the lens or color-filter material. Such changes in temperature may have a very substantial effect upon both the efficiency of transmission and the spectral quality of the transmitted light.

Gaseous discharge lamps commonly are considered to have characteristic colors which are dependable, but Dr. Breckenridge stated that this is not entirely true. For example, loss of gas pressure with age results in a loss of color value. In the case of discharge lamps which contain mercury, there may be a large change in color value as ambient temperature varies.

The third determination which should guide those preparing specifications for signal-light colors is the necessity for enforcement of the specifications. As very few, if any, laboratories have colorimeters which will give direct readings of test samples, the determination usually depends on a direct visual comparison of the light emitted from a test sample with light from calibrated lamp transmitted through standard filters. In the types of tests which can be made by the usual inspector, Dr. Breckenridge pointed out that the comparisons usually are limited to discriminations of hue and of saturation. In view of this he considers it advantageous so to draw specifications that only this type of comparison is required in the testing of equipment for conformity with governing specifications.

In concluding his analysis of the problems involved in the preparation of specifications for color signals, Dr. Breckenridge urged the desirability of a simplification of color names. For example, there is an "aviation green," a "railroad green," a "traffic green," and a "marine green." What is green?

Airport Surface Traffic Control

The problem of controlling surface traffic on airports, both aircraft and airport vehicles, is a relatively new one deriving from the large physical dimensions to which modern airports have grown and from the necessity to operate aircraft under weather conditions which approach the so-called "zero-zero" planes of disability. Under these conditions, the traffic-control personnel in airport control towers are confronted more and more frequently with occasions when they are unable to monitor and control runway traffic safely and expeditiously, for the simple reason that they do not have reliable information, visible or otherwise, as to the locations and movements of such traffic.

In discussing these problems, Captain Cogswell, Navy Member, of the Air Navigation Development Board, mentioned that at well designed airports the present state of operational practice permits aircraft to land on runways serviced by Instrument Landing Systems and runway lights at minima of 200 ft. ceilings and one-half mile visibility. Also, that current improvement in I.L.S., plus Ground-Control-Approach monitoring, plus slope-line approach lights and high intensity runway lights, "should yield practical minima of 100 ft. ceiling and one-fourth mile visibility."

"The mere statement of these two figures has two outstanding implications," stated the Captain, "first, that emergency situations requiring landing at much lower minima will develop frequently, especially in the case of military operations; second, that we are now dealing with a new order of precision weather measurements. Instead of measurements of ceiling and visibility accurate to 100 feet and one-quarter mile, we now need measurements at the landing slope and runway surfaces to a considerably greater precision. . . . Much progress is being made at Arcata in defining the problem of microscopic weather measurement, in contrast to the macroscopic measurements with which we are now familiar. . . . A survey of available techniques has yielded no panacea. . . . It must be remembered that the system must take care of aircraft not equipped to operate at the lowest practicable minimums and that the system must in no wise degrade the VFR capacity of the airport. Thus, in the opinion of many, electronic landing and taxi aids never will replace visual aids in any time that we need to worry about."

In discussing the development program of the Air Navigation Development Board, Captain Cogswell reported that "the ultimate ANDB program contemplates the greatest possible integration of all aids into two airborne equipments, one for the navigation and one for the traffic-control function, and their development to accuracy and reliability standards suitable for all-weather use, in accordance with the guide plan of the RTCA SC-31 study. This plan advocated a pictorial situation display for the pilot's navigation equipment which would be switched successively to depict en route, approach, landing, and runway geographic and traffic information. Intensive development of picture transmission and display techniques since the RTCA study make it even more probable now that the television industry will contribute the necessary techniques for the ultimate situation display in a surface traffic control system. However, it is not at all apparent that such a system can displace approach, runway, or taxiway lights, or that such lights of improved characteristics need not be developed for their fitted place in a well rounded out system."

Aircraft Position Lights

Position lights are to an airplane what navigation lights are to water craft. Their prime purpose is the prevention of collisions, and they do this by first attracting attention by virtue of the distinctiveness of a lighting signal, and secondly by indicating the distance, attitude, heading, and speed of the craft to which they are attached. The critical importance of early and accurate identification of such signal lights becomes apparent when one remembers that it is now physically possible for two aircraft to be approaching each other at a relative speed of 1400 miles per hour (approximately 2000 feet per second!) and that relative speeds up to 2,000 miles per hour (1,000 miles per hour per each aircraft) are within the range of reasonable contemplation. Another angle of the problem may be understood by almost any automobile driver who has experienced the difficulty of identifying and accurately judging the position of vehicular or traffic-control lights in the face of the glare from on-coming headlights; and that is the problem of locating and identifying the color of aircraft navigation lights against a background of city lights, a condition commonly prevailing in the vicinity of airports.

In discussing these problems, Mr. H. F. Tanke of Civil Aeronautics Administration of Washington pointed out that experience and recent experiments pointed to the need for aircraft navigation lights of greatly increased brightness and positive long-range color identity, coupled with an appropriate flashing system. For example, the intensities sought are of the order of 5000 as compared with a present maximum on the order of 200 foot-candles. High intensity lights introduce their own difficulties, not only with reference to the dimensions of aircraft wing tips, etc., but also in the matter of intensifying any atmospheric haze conditions by glare-reflection. In the discussion which ensued, it was generally agreed that navigation lights of any nature are at best a fair-weather measure only; that attention must be directed toward the development of electronic equipment for the aircraft-to-aircraft signals necessary for safety in high speed and poor-visibility flying.

British Installation Described

During the past few years people have become so accustomed to large airports with paved runways that they forget that such runways began to come into general use only about ten years ago. The war came at a time when airports were beginning to be expanded in size and to take a new form. War requirements resulted in large numbers of airports all over the world, and visual aids of necessity had to be installed without much time for development and without any attempt at standardization as between one country and another. Since the war, a considerable number of airports intended primarily for international transport has been and are being developed, and if the visual aids are not standardized and integrated with the radio aids within the next year or two, the situation well may become chaotic. Even now, scale effects caused by different facings between rows of runway lights are large enough to cause appreciable misjudgments in height in conditions of poor visibility.

These and related problems were discussed in a paper prepared by E. S. Calvert of England.

Mr. Calvert described the Royal Aircraft Establishment at Farnborough, and presented an outline of the theoretical and experimental bases which he considered to be of importance in the standardization of the visual aids on civil airports. A full and detailed discussion may be found in a paper presented by Mr. Calvert to the Royal Aeronautical Society and published in the Journal of that Society for July 1948.

Aviation Data for Lighting Engineers

Frequently it becomes necessary for the aviation lighting engineer to have accurate information as to procedure and regulations controlling the activities of aircraft, that he may adapt his designing and planning of visual landing and navigation aids to actual rather than theoretical conditions. Recognizing this need, Marcus S. Gilbert of the Civil Aeronautics Authority, Indianapolis, presented a paper in which he gave a digest of "basic information on flight operation for aviation lighting engineers." This paper included a digest of the CAA regulations, reflecting the legal requirements; also tabulated data reflecting the normal performance characteristics of the several major types of aircraft currently in general operation.

Arcata Experiment Evaluated

As reported from time to time in previous issues of Illuminating Engineering, full-scale operational tests of various landing-aids systems have been in progress for some time at Arcata, California, at the Airforce-Navy Civil Aeronautics Landing Aids Experiment Station. Arcata, in the northwestern corner of the State of California, has the well earned reputation of having the most "impossible" weather, a condition which arises from moisture-laden prevailing westerly winds coming in off the ocean over an area of exceptionally cold water along the shore to form fog. On this basis, if a landing aids system can be made to work satisfactorily at Arcata, it should with assurance perform anywhere else.

In the course of the past fifteen months, the development and evaluation of visual low-approach and landing aids for aircraft has advanced speedily and methodically toward a practicable solution of the fundamental problem of three-dimensional visual guidance in the absence of a natural ground plane for the direct visual guidance of an aircraft pilot. The results of an exhaustive survey and evaluation of the experimental work at Arcata and elsewhere were presented in detail by Dr. Maurice A. Garbell, Consulting Engineer of San Francisco, California. The following represents a summary of Dr. Garbell's evaluation of approach-light systems.

"The Slope-line Approach Light System appears to provide the required elements of identification and guidance more effectively than does any other approach-light system tested at Arcata during the 1948 fog season. Further improvement could be achieved by selective toe-in and by modified angular elevation of some of the individual slope-line lamp units in the outer portion of the system. The slope-line system excels in good elevation, transverse, and directional guidance; but only moderately bank guidance, and guidance information as to the distance of the incoming aircraft from the end of the runway only to the extent of that provided by the runway threshold markings and

perspective depth perception of the individual units.

"In the Slope-line System, the pilot flies ideally in a dark lane between two parafoveally perceived lines of guiding elongated light bars. If inadvertently he deviates from a well-centered approach, the pilot is confronted with the appearance of a brilliant barrier of staggered lights which serves as a forceful and unmistakable warning.

"The British RAE (Calvert) Transverse-Bar Approach-Light System excels in providing good direction-and-bank guidance, together with glide-path-position-guidance (by means of a successive triple, twin, and single centerline of point sources in the respective longitudinal 1000-foot distance intervals of the 3000-foot system) so long as the aircraft enters the system well centered on the extended axis of the runway. Elevation guidance is provided in spurts only, without continuity, and is only moderately effective. In the Calvert System, the pilot flies ideally along and above a centerline of lights. But, if, in an excessive corrective maneuver, the pilot inadvertently crosses the centerline of the Calvert System, he may without any further warning find himself with all effective visual aids *behind* him; hence, a pull-up may become unavoidable.

"It is the considered opinion of the author that the two most effective approach-light systems—Slope-line System—are 'competitive' in only one respect and complementary in all others. The 'competitive' element concerns the preference of some pilots toward 'flying down a centerline of lights' and that of other pilots toward flying 'down a dark lane' with an alignment of lights along either flank of the lane. In every other respect it appears that the highly effective elevation, transverse, and direction guidance afforded by the Slope-line System should be supplemented with the excellent bank guidance provided by the Calvert System, and that a distance-from-the-runway element be supplied comparable in effectiveness at least to that of the Calvert System."

School Lighting a Feature of Several Educational Conferences

Several educational conferences throughout the country have featured school lighting as the sole discussion on school improvement. This interesting trend is noted in a number of conferences not directly connected with lighting interests, as well as some on which local groups of the Illuminating Engineering Society have specifically cooperated.

Of the latter, two of interest included meetings at the George Peabody College for Teachers, Nashville, Tenn., and at the University of Pittsburgh, cooperating sponsors of which were the Tennessee Valley Chapter and Pittsburgh Section of I.E.S. respectively.

Pittsburgh

In Pittsburgh, a Tri-State Institute on Classroom Planning was held November 9 and 10, under the auspices of the School of Education, University of Pittsburgh, for the purpose of bringing to school administrators and their architects a synthesis of the most educationally-meaningful aspects of school lighting investigations. Chief speaker at the two-day conference was Dr. Darrell Boyd Harmon, consulting educationist, who gave six full lectures on various phases of his studies on the coordinated classroom. Dr. Harmon spoke on developmental hazards of the school, problems in school lighting, daylighting, decorating and equipping the coordinated classroom.

While the program covered many phases of school-child development, ten of the fifteen lectures given were on lighting in its relation to classroom environment. In addition to Dr. Harmon's discussions, other lighting lectures included:

Developmental Aspects of Seeing—by G. A. Getman, O.D., Yale University.

Vision and Learning—by A. M. Skeffington, O.D., Director of Graduate Clinic Foundation, Optometric Extension Program.

Recent Advances in Lighting—by A. A. Paulus, illuminating engineer, Westinghouse Electric Corp.

Sound-Slide Film in Color, "Educating in a Truer Light," Better Light-Better Sight Bureau.

A major feature of the Tri-State Institute was an exhibit using large scale models by which a "coordinated classroom" could be compared to the conditions existing in so many classrooms. The exhibit illustrated the Harmon techniques in window fenestration, decoration, illumination and seating arrangement.

Sponsors of the meeting, in addition to the Pittsburgh Section of the Illuminating Engineering Society, were the Pittsburgh Optometric Society, Pennsylvania Association for the Blind, Pittsburgh Chapter of American Institute of Architects, and Electric League of Western Pennsylvania.

Nashville

The Nashville meeting, held at Peabody Demonstration School November 17 and 18, featured a two-day program devoted entirely to school lighting, and was attended by architects, school superintendents and principals, State Department of Education representatives, among others, from all of the southeastern states. Subjects covered discussion on:

The Importance of Good Seeing Conditions in the Classroom as a Factor in Learning and General Student Welfare—by Dr. W. D. McClurkin, Professor of School Administration, Peabody College for Teachers.

Advances in Schoolhouse Illumination—by James M. Ketch, General Electric Co., Nela Park, Cleveland, Ohio.

The Importance of Brightness Balance to Visual Comfort and Efficiency—by Dr. N. E. Viles, Specialist for School Plant Management, U. S. Office of Education, Washington, D. C.

Utilization of Natural Lighting in the School Building—by R. W. McKinley, Product Development Engineer, Pittsburgh Corning Corp., Pittsburgh, Pa.

Designing and Selecting Lighting Fixtures for the School Classroom—by J. J. Neidhart, Lighting Division, Westinghouse Electric Corp., Cleveland, Ohio.

The Use of Color in the School Classroom—by E. M. Hill, Technical Supervisor, E. I. du Pont de Nemours and Co., Atlanta, Ga.

Cooperating sponsors of the Nashville conference included, in addition to the Tennessee Valley Chapter of I.E.S., the Interstate School Building Service and Tennessee Valley Authority.

M.I.T.

At the Massachusetts Institute of Technology, Cambridge, Mass., a two-day program was held November 4 and 5, scheduled as the New England School Development Council Conference on Better Seeing for Better Schools. Some 50 members of the Illuminating Engineering Society and the Electrical Association of Boston joined with more than 250 superintendents, principals and teachers in the program.

The opening session of the New England Conference was led by Dr. D. B. Harmon, who spoke on "Classroom Environment and Child Development." Seven members of a panel representing architects, vision specialists, and educators extended the scope of the meeting by contributing short talks on their specialties.

At the afternoon session on November 4, key speaker was Dr. Domina Spencer who lectured on "Classroom Lighting and Decoration." Dr. Spencer also was aided by a panel whose members covered some of the physical features of the classroom—desks, wall surfaces, tack boards, etc.

The third and final session in the evening was again led by Dr. Harmon. Here the emphasis was on the classroom as part of the school as a whole, with architectural factors dominating the discussion. Willard Allphin, New England I.E.S. Section Chairman, was one of the panel members and thus contributed the lighting engineer's viewpoint.

Starting early on Saturday morning, November 5, a 40-mile auto trip to progressive communities attracted about 100 of those who participated. Outstanding was a rehabilitated schoolroom in Newton Highlands, with a corrugated plastic ceiling, and a new school in Lexington with a clerestory and side-wall window arrangement to secure maximum uniformity of natural lighting. Informal on-the-spot questioning of these schools took over a half hour each, the period being limited by the necessity of maintaining a travel schedule.

The large number who took part in the program, the freedom with which they expressed their views, and the challenging questions and comments from panel members and audience alike, make this program an outstanding contribution to the new lighting season. It seems certain that the educators who attended left with renewed respect for the importance of environment in school buildings, and the many ways in which natural and artificial lighting contribute to its proper fulfillment.

St. Paul

A similar school lighting conference was held in St. Paul, Minn., September 29-30, in the "Institute on Classroom Planning" conducted by Dr. Harmon. The school planning conference there was presented for school planners by the St. Paul Public Schools, with a program including:

Developmental Hazards of the School—by Dr. D. B. Harmon.

Health and Developmental Problems of School Children—by Dr. Charles Steinberg, Pediatrician.

Light and Vision—by Dr. Miles Tinker, Professor of Psychology, University of Minnesota.

Vision and Learning—by Dr. R. R. Tracht, American Board of Ophthalmology.

Problems in Classroom Lighting—by Dr. D. B. Harmon.

Recent Advances in Lighting—by Lawrence Paist, Twin City Section of Illuminating Engineering Society.

Daylighting the Coordinated Classroom—and Artificial Lighting in the Coordinated Classroom—by Dr. Harmon.

Decorating the Coordinated Classroom—by Dr. Harmon.

Equipping the Coordinated Classroom—by Dr. Harmon.

The Curriculum and the Classroom—by Dr. Nolan C. Kearney, Assistant Superintendent, Research and Curriculum, St. Paul Public Schools.

Interpreting Function in Classroom Structure—by W. Brooks Cavin, Jr., American Institute of Architects.

Vision and the School—by Dr. A. M. Skeffington, National Education Director, Optometric Extension Program.

A Program of Classroom Improvement—by I. O. Friswold, Director, Division of Buildings, State Department of Education.

Southeastern Industrial Vision Congress Features Lighting in Industry

The importance of lighting in the field of industrial vision was a keynote, for the first time, of the 1949 Southeastern Industrial Vision Congress, held at the Georgia Institute of Technology, Atlanta, Ga., on November 6 to 9.

The Congress, only meeting of its kind in this country, is a well-attended and important gathering sponsored by leading optometrists, optometrical manufacturers, and Georgia Institute of Technology, to bring together people interested in the safe-guarding of industrial vision. The Congress, held annually, is believed to be the first major event in which vision specialists, lighting engineers, color specialists, safety engineers and educators combine their efforts toward improving environment in industry. Some 165 industrial and vision specialists attended the Atlanta meeting.

Keynote speaker at the opening session November 6 was Dr. Matthew Luckiesh, Director of the Lighting Research Laboratory of General Electric Co., Nela Park, Cleveland, Ohio. Dr. Luckiesh opened the Congress with an address on "Light Vision and Seeing." Industrialists were urged by Dr. Luckiesh to "pull your workers out of the dark." He said that workers' eyes have in the past been seriously neglected.

"Seeing is the most important operation of an individual in industry," Dr. Luckiesh said, "and yet we don't have seeing specialists in our plants. The production, efficiency, comfort and welfare of a worker are all dependent upon his eyes."

The program during the Congress also included two other leading exponents of lighting for industry—T. R. Quisenberry of the E. I. du Pont de Nemours Co., Wilmington, Delaware, who spoke on "Color in Industry," and George J. Taylor, New York and Eastern Manager of Day-Brite Lighting Inc., whose subject was "Industrial Lighting."

"Improved lighting throughout the industry would up the nation's production, in all probability, by more than 600 million man-hours a year," Mr. Taylor told the group. He stressed that in spite of high-speed automatic machinery, a fast-seeing, clear-thinking workman is the most important production machine in the factory.

"If the employe is not seeing at his maximum ability, some corrective measures should be taken without delay,"

he pointed out, "adding that 80 per cent of the workman's actions are eye-controlled.

Mr. Taylor was introduced by Joseph B. Browder, upcoming young executive for the Georgia Power Co., and Regional Vice-President for the Southern Region of I.E.S. Mr. Browder served as a member of the program committee for the Congress.

Industrial executives who spoke at the Congress included G. Luther Weibel, Jr., personnel director for Magnet Mills Inc., Clinton, Tennessee; Frank H. Emerick, safety director, Southern States Iron Roofing, Savannah, Georgia; B. G. Byron, Clearwater Finishing Mills, Old Fort, North Carolina; and Charles T. McNary, public relations and personnel director, Blue Bell, Inc., Greensboro, North Carolina.

I.E.S. Medal Nominations Due by January 1st

Members of the Society are invited to submit nominations to the Medal Committee up to January 1st, according to the procedure under which the Committee now operates. The Rules of Procedure adopted by the Committee in 1945-1946 include the following instructions:

Candidates for the award need not be members of the Society, and may be nominated at any time by any voting member of the Society, by presenting to the Committee on Award the name of the individual whose accomplishments in his field are deemed worthy of such recognition. Each nomination should be accompanied by a comprehensive statement of the candidate's achievements, whether it be in the field of engineering, design, applied illumination, optics, ophthalmology, lighting research, education, or administration and management.

In order for a candidate to be considered for the award of a given year, the following shall be delivered at the General Office before January 1st—(a) A written nomination giving personal and general information to fully identify the candidate. (b) A statement of the candidate's achievements on which the recommendation is based. This statement shall be signed by the person responsible for the information, not necessarily a member of the Society, if known otherwise, also giving the names of four persons, preferably I.E.S. members, who can testify to the candidate's achievements.

Previous awards of the I.E.S. Medal, established in 1944, have been made to George H. Stickney, Preston S. Millar, E. C. Crittenden, Matthew Luckiesh, Sir Clifford Paterson and Ward Harrison. The Medal was established for the purpose of giving recognition to meritorious achievement which has conspicuously furthered the profession, art or knowledge of illuminating engineering.

Nominations should be sent to the I.E.S. Medal Committee in care of the General Offices of the Society. Inquiries concerning nominations may be addressed to the Executive Secretary, A. D. Hinckley, at headquarters.

E.C.P.D. Holds Annual Meeting

At the recent Engineers' Council for Professional Development, 17th Annual Meeting, held in Chicago October 28, I.E.S. was represented in the person of J. L. Stair, Fellow and Member Emeritus. Mr. Stair, a past-president of the Society, attended the annual dinner of the E.C.P.D. meeting at the request of President Goddard.

The program of the full-day sessions featured at the meeting included a Report to the Council by the Council's Chairman, J. W. Parker.

Spare Copies of Transactions Needed at I.E.S. Headquarters

The headquarters stock on certain issues of ILLUMINATING ENGINEERING is now very low. If any members have extra copies of the following numbers, the I.E.S. office would be happy to receive them. Copies addressed to A. D. Hinckley, Illuminating Engineering Society, 51 Madison Ave., New York 10, N. Y. would be gratefully received. Those needed are:

1940—November
1942—January-February
1943—February
1944—September
1945—November
1947—January

A Real "Drop Test"

As evidence of the continuing contest between container manufacturers on the one hand and delivery personnel and "baggage smashers" on the other hand, we note an item in a recent issue of *Electric Review* (London) It seems that, to demonstrate the shock absorbing qualities of a new type of carton designed for electric lamps, some 64 electric lamps in those cartons were dropped from 2500 feet to the ground from an airplane. Fifty-two were dropped singly, and the remaining 12 were dropped in cartons of 6 each, with the explanatory statement that "the Americans sell lamps in half dozens."

The report states that only one lamp was damaged, and even then the glass was not broken. The carton is made from a single piece of cardboard, with interlocking flaps which meet around the neck of the lamp to hold it firmly in center position. The top of the lamp bulb rests against four small shock absorbers, and the rest of its surface makes no contact with the carton at all.

Finnish I.E.S. Again Active

The Central Bureau of I.C.I. has received a report on the convention of the Finnish Illuminating Engineering Society held in Helsinki last July. Some 66 delegates attended the meeting, including representatives from all of the Scandinavian countries.

In addition to the technical program, the convention featured inspection tours of Finland's largest fluorescent school lighting installation, glass works, etc.

Technical subjects discussed included techniques of writing illuminating engineering treatises; advancements in Swedish illuminating engineering; importance of co-operation in the development of illuminating engineering; and daylight studies in Finland.

The next meeting of illuminating engineers of the northern countries is scheduled for Oslo, Norway, in 1950.

National Technical Conference at Pasadena in 1950

The Society's National Technical Conference will be held August 21 to 25, 1950, at Pasadena, California. Conference headquarters will be the Huntington Hotel. Plans are already under way under the direction of the Conference Committee and the local Executive Committee, D. W. Prindeaux, Chairman.

ABOUT PEOPLE

Henry L. Logan, formerly manager of the Department of Applied Research for Holophane Inc., New York, has been elected Vice-President in charge of Research by the Holophane Board of Directors. In his new position Mr. Logan expects to put more emphasis on careful research in the products, application techniques and marketing practices of the company. A Fellow of I.E.S., Mr. Logan is well known for his many years of lighting researches, developments and lectures.

K. E. Estler has joined the General Electric Lamp Department as District Engineer in the newly formed Connecticut Valley Sales District, with headquarters in New Haven, Conn. The new district consists of Connecticut, Vermont and Western Massachusetts and is managed by E. A. Hawkins. After intensive training at Nela Park, Mr. Estler will return to New Haven and in his new capacity will handle engineering and lighting layout work for the new district as well as sales work for several accounts serviced from the New Haven headquarters. Mr. Estler last year was Chairman of the Connecticut Section of I.E.S. and over a period of years has held several committee appointments.

William A. Heth has been named sales representative for the F. W. Wakefield Brass Co., covering the eastern half of Wisconsin. Before the war Mr. Heth specialized in outdoor lighting. During the war he acted as chief electrical supervising engineer at the Milwaukee Ordnance Plant.

Warren D. Anderson has been named Development Engineer, and **E. A. Neckopulos** as illuminating engineer for the Northern Light Co., Milwaukee, Wisconsin. Both men are specially trained and experienced in lighting problems and are members of I.E.S.

Robert S. Rogge has been appointed field engineer for the Miller Co., Meriden, Conn., and given charge of a new sales area for the company, the state of Michigan, with headquarters in Detroit. Mr. Rogge joined Miller in 1947 as electrical engineer under G. W. Beals. He was previously associated with the Westinghouse plant in Pittsburgh, and with the Duquesne Lighting Co. During the war he became affiliated with the civil service branch of the U. S. Signal Corps as radio engineer.

Mr. Rogge's successor as illuminating division engineer is **Howard B. Sohn** formerly of Sperry Gyroscope Co., Great Neck, L. I.

J. W. Fowler has recently joined the Illuminating Division Sales Force of Miller Company and will cover the state of Tennessee formerly covered by the late **Charles Booker**. Previously, Mr. Fowler had been associated with the General Electric Supply Corp. in Tennessee in the lamp and lighting sales department and with Kraft Foods. During the war he served as an Ensign in the Navy.

BOOKS AND PAMPHLETS

The concept that scientific lighting is a factor in the promotion of the healthy growth of a child is very comprehensively developed in **The Co-ordinated Classroom**, a 52-page booklet by Dr. Darrell B. Harmon. Copies of the book in 8½ x 11 inch photo offset are being distributed by the F. W. Wakefield Brass Co., Vermilion, Ohio, and the American Seating Co., Grand Rapids, Mich., free on request.

Dr. Harmon's premise is that the human organism "strives to grow, develop and function as an integrated whole." The growing child responds to physical environment by seeking physical balances with the environmental forces or restraints. "The work environment must be equally co-ordinated with the child if we would have the child arrive at optimum maturity."

The 18 pages of the first section of his book present preliminary findings and conclusions based upon a three-year study by the Texas Interprofessional Commission on Child Development (14 state organizations which Harmon headed) of 160,000 elementary school children and the 4,000 classrooms which they utilized. "Analysis . . . showed that at least 52 per cent of the school children were leaving . . . with an average of 1.8 defects" which could be seen, and prevented. Environment of improper seating, improper lighting, and improper placement of working material were among the chief offenders against the child's welfare. Photographs, including X-ray, and sketches show the ill effects of improper environmental factors upon the pupil.

Part two reveals findings, further studies and the experimental work "to develop principles and basic methods for controlling the adverse physical factors. . . ." The initial examinations had disclosed the incidence of organic and functional, clinical and subclinical difficulties which included visual, nutritional, postural, signs of chronic infections, possible chronic fatigue and dental difficulties, ranging in all from 92 per cent to 20.9 per cent.

Classrooms were designed and built to offset causes for these difficulties, and experimental centers set up for comparison of the old and new. From these it was possible to arrive at comparisons — by health problems — by achievement — and by grades and rooms. There was no doubt of the efficacy of improved seating, lighting and placement of working material. This section relates and illustrates principles, and gives specific data as to physical equipment put into use in the classroom.

In part three, Dr. Harmon covers theory and practice of seeing, and how the practice is influenced environmentally by light control (day and artificial). The section on decoration is almost a text on reflectances of walls, ceilings, and working surfaces, color, and the comparative brightnesses which result from various combinations. Furniture selection is also detailed as a vital part of the "co-ordinated environment."

It is profusely illustrated by charts, photographs, sketches, and graphs.

IT SEEMS TO ME

To the Editor:

The following clipping from a recent issue of the Cleveland Plain Dealer ought to be published in the

"It's About Time" department: "Cleveland has taken the leadership in a relatively new approach to the problem of adequate street lighting.

"Hitherto cities had tackled the problem chiefly in terms of power used, type of fixtures and proper placing of those fixtures. The new approach is through scientific selection of pavement for the best reflecting quality.

"For a year and a half a special subcommittee of the Cleveland Automobile Club's safety advisory board has been investigating pavement reflectivity. The subcommittee consists of City Treasurer Leonard Levy as chairman, Traffic Engineer Vurnen L. Johnson and William A. Billings of the club.

"At the same time the city of Cleveland, through the efforts of Fred T. Vitovec, assistant street commissioner, has been experimenting with several types of sand, slag and stone aggregates on a number of street paving jobs.

"The club subcommittee recently called together John C. Wenrick, engineering commissioner for the city; Vitovec; William T. Sojeba, city street lighting commission; Alvin Kohn of the Horvitz Construction Co., and Kirk Reid, Nela Park authority on illumination.

"As a result of this meeting, Reid has offered to set up light measuring equipment at a number of places where experimental types of paving have been used, thus providing the city with a means of determining which type has the best reflecting quality. He also has offered to make a series of laboratory tests.

"It is only in recent years that paving engineers have been giving any attention to the fact that lighter colored roads and mat surfaces reflect several times as much light back to the driver as do darker roads or glossy surfaces.

T. D. Wakefield,
F. W. Wakefield Brass Co.,
Vermilion, Ohio.

NEW MEMBERS

At the meeting of the Council Executive Committee held November 9, 1949, the following were elected to membership:

Baltimore Chapter

Associate Member:

Pugh, T. J., The Wiremold Co., Hartford, Conn.

Carolinas Chapter

Associate Members:

Miller, P. E., Mill Power Supply Co., Charlotte, N. C.

Rhodes, C. A., Jr., Northrup & O'Brian, Winston-Salem, N. C.

Central New York Chapter

Associate Member:

Leverence, G. W., General Electric Co., Utica, N. Y.

Chicago Section

Associate Members:

Coxhead, Sheldon A., Central Illinois Electric & Gas Co., Rockford, Ill.

Heins, V. H., Luminator, Inc., Chicago, Ill.

Student Members:

Holzinger, J. R., 11542 S. Normal Ave., Chicago, Ill.

Tiedemann, A. T., University of Illinois, Urbana, Ill.

Turchin, B. B., Institute of Design, Chicago, Ill.

Cleveland Section

Associate Members:

Conner, Don, Westinghouse Electric Corp., Cleveland, Ohio

Klyne, J. A., Westinghouse Electric Corp., Cleveland, Ohio

Thurston, V. D., Westinghouse Electric Corp., Mansfield, Ohio

Student Members:

Love, E. B., Case Institute of Technology, Cleveland, Ohio

Myers, C. G., Case Institute of Technology, Cleveland, Ohio

Rieke, W. R., Case Institute of Technology, Cleveland, Ohio

Whitwell, Omer D., Case Institute of Technology, Cleveland, Ohio

Cornhusker Chapter

Associate Member:

Bates, Ford, Omaha Public Power Dist., Omaha, Neb.

Eastern Pennsylvania Chapter

Associate Member:

McDowell, E. L., Edison Light & Power Co., York, Pa.

Florida Chapter

Associate Member:

Porter, L. E., Ace Electric Supply Co., Jacksonville, Fla.

Foreign Non-Section

Associate Member:

Aranguren, Eduardo L., Asociacion Espanola de Luminotecnia, Avenida de Jose Antonio 31, Madrid, Spain

Georgia Section

Member:

Howe, C. F., 431 Candler Bldg., Atlanta, Ga.

Associate Member:

Pettijohn, W. J., Westinghouse Electric Corp., Birmingham, Ala.

Whitaker, W. E., General Electric Co., Atlanta, Ga.

Heart of America Section

Associate Members:

McDonald, J. G., Graybar Electric Co., Kansas City, Mo.

Young, G. S., Kansas City Power & Light Co., Kansas City, Mo.

Indiana Chapter

Member:

Chiang, Felix Y. K., P. O. Box 187, Bloomington, Ind.

Associate Members:

McIlvaine, D. K., Jr., Public Service Co. of Indiana, Columbus, Ind.

Rouse, Cecil W., Public Service Co. of Indiana, Inc., Lafayette, Ind.

Maritime Chapter

Associate Member:

Stevenson, R. H., Canadian Westinghouse Co., Ltd., Moncton, N. B., Canada

Michigan Section

Members:

Cowgill, E. A., Floodlight Service, Detroit, Mich.

Earley, H. P., Consumers Power Co., Grand Rapids, Mich.

Mueller, L. E., The Detroit Edison Co., Detroit, Mich.

Associate Members:

Boyden, W. B., Boyden Electric Supply Co., Muskegon, Mich.

De Vos, J. H., General Electric Supply Corp., Grand Rapids, Mich.

Harper, D. A., General Electric Supply Corp., Grand Rapids, Mich.

Hormig, E. H., Clement Electric Co., Grand Rapids, Mich.

Knudstrup, R. J., Knudstrup Electric Co., Manistee, Mich.

Lett, M. A., Michigan Trust Bldg., Grand Rapids, Mich.

Newkirk, Arthur, Clement Electric Co., Grand Rapids, Mich.

Nurnberger, L. L., Consumers Power Co., Manistee, Mich.

Reed, Morton L., Jr., Consumers Power Co., Grand Rapids, Mich.

Reilly, C. E., Consumers Power Co., Jackson, Mich.

Reynolds, G. B., Commonwealth & Southern Corp., Jackson, Mich.

Schneider, Jack, Grand Rapids Indus-

Continued on page 19A

SUSTAINING MEMBERS

Acme Electric Corp.
Cuba, N. Y. *J. A. Comstock*

Admiral Lamp Manufacturing Corp.
2430 So. Ashland Ave., Chicago, Ill.
F. Schwartz

Advance Transformer Co.
1122 W. Catalpa Ave., Chicago 40, Ill.
Hirsch Epstein

Alabama Power Co.
Birmingham, Ala. *George L. Morris*

All Bright Electric Products Co.
3917-25 N. Kedzie Ave., Chicago 18, Ill.
Max Klein

Aluminum Company of America
Gulf Building, Pittsburgh 19, Pa.
C. Braglio

Amalgamated Electric Corp., Ltd.
384 Pape Ave., Toronto, Ont., Canada
D. W. Patterson

American Concrete Corp.
4727 North Lamon Ave., Chicago 30, Ill.
J. W. Lewis

American Fluorescent Corp.
5407 Broadway, Chicago, Ill. *William Rusnak*

American Sterilizer Co.
Erie, Pa. *Horace Wm. Alexander*

Appleton Electric Co.
1701-1739 Wellington Ave., Chicago 13, Ill.
Nils A. Tornblom

Arkansas Power & Light Co.
Simmons National Bldg., Pine Bluff, Ark.
Max Sudduth

The Art Metal Co.
1814 E. 40th St., Cleveland 3, Ohio
George E. Glatthar

Artistic Lamp Manufacturing Co., Inc.
395 Fourth Ave., New York 16, N. Y.
Myron Perlmutter

Bausch & Lomb Optical Co.
Rochester 2, N. Y. *David L. Williams*

Benjamin Electric Mfg. Co.
Des Plaines, Ill. *John H. Waterbury*

Blue Ridge Glass Corp.
Kingsport, Tenn. *J. H. Lewis*

Board of Water and Electric Light Commissioners
116 W. Ottawa St., P.O. Box 570, Lansing 3, Mich. *John D. Malnight*

Boston Edison Co.
39 Boylston St., Boston 12, Mass.
R. B. Brown, Jr.

Branham, Mareck & Duepner, Inc.
7020 Walker St., St. Louis Park, Minneapolis 16, Minn. *Cecil H. Branham*

Bright Light Reflector Co., Inc.
Fairfield & State, Bridgeport 5, Conn.
C. E. Scholl

British Columbia Electric Rwy. Co., Ltd.
570 Dunsmuir St., Vancouver, B. C., Canada
H. N. Walters

Brockton Edison Co.
36 Main St., Brockton 67, Mass.
W. A. Forbush

Buffalo Niagara Elec. Corp.
Buffalo 3, N. Y. *Jack F. Parsons*

Edward F. Caldwell & Co., Inc.
101 Park Ave., New York 17, N. Y.
E. T. Caldwell

California Electric Power Co.
P.O. Box 512, Riverside, Calif.
W. E. Vaughn, Jr.

Cal-Lite, Inc.
12600 S. Yukon Ave., Hawthorne, Calif.
N. L. Ureles

Calpa Products Co.
4116 Chester Ave., Philadelphia 4, Pa.
Paul C. Calieri

Cambridge Electric Light Co.
46 Blackstone St., Cambridge 39, Mass.
Reginald H. Bowman

Canadian General Elec. Co., Ltd.
212 King St., Toronto, Ont. *R. M. Love*

Canadian Laco Lamps, Ltd.
745 Guy St., Montreal, Que. *J. Thomas*

Canadian Line Materials, Ltd.
Postal Station H, Toronto 13, Ont., Canada
L. E. Messinger

Central Hudson Gas and Elec. Corp.
50 Market St., Poughkeepsie, N .Y.
H. E. Dexter

Central Illinois Light Co.
316 Jefferson Ave. S., Peoria 2, Ill.
R. K. Dallas

Central Illinois Public Service Co.
607 E. Adams St., Springfield, Ill. *B. L. Palm*

Central Maine Power Co.
9 Green St., Augusta, Maine *Roland W. Hess*

Central New York Power Corp.
300 Erie Boulevard W., Syracuse, N. Y.
L. D. McCormac

Central Power & Light Co.
P.O. Box 2121, Corpus Christi, Texas
James M. Williams

Champion Lamp Works Div. of Consolidated Electric Lamp Co.
600 Broad St., Lynn, Mass. *Ellery H. Raddin*

Cincinnati Gas & Electric Co.
Fourth & Main Sts., Cincinnati 1, Ohio
J. R. Hartman

Circlite Corp.
118 So. Clinton St., Chicago, Ill.
George Gomberg

City of Burbank, California Public Service Department
174 W. Magnolia Boulevard, Burbank, Calif.
J. H. McCambridge

City of Glendale Public Service Dept.
119 N. Glendale Ave., Glendale 6, Calif.
P. Diederich

City of Riverside Electric Light Dept.
3854 Mulberry St., Riverside, Calif.
L. W. Grayson

City of Seattle, Dept. of Lighting — Puget Sound
1015 Third Ave., Seattle 4, Wash.
P. C. Spowart

City of Tacoma, Light Division
Tacoma 2, Wash. *Ray H. Weston*

Colonial Electric Products Co., Inc.
1-115 Market St., E. Paterson, N. J.
Wallace M. Woodworth

Colonial Premier Co.
466 W. Superior St., Chicago 10, Ill.
Richard Weis

Commercial Light Co.
841 W. Washington Blvd., Chicago, Ill.
Michael R. Fine

Commonwealth Edison Co.
72 W. Adams St., Chicago 90, Ill.
Ralph G. Raymond

The Connecticut Light & Power Co.
250 Freight St., Waterbury 91, Conn.

Consolidated Edison Co. of N. Y., Inc.
4 Irving Place, New York 3, N. Y.
Clarence Law

Consolidated Gas, Elec. Light & Power Co. of Baltimore
100 W. Lexington St., Baltimore 1, Md.
R. H. Tillman

Consumers Power Co.
212 Michigan Ave. W., Jackson, Mich.
D. E. Karn

Consumers Public Power Co.
1452-25th Ave., Columbus, Nebraska
W. H. Sinks

Corning Glass Works
Corning, N. Y. *A. S. Tyler*

Coyne Electrical School, Inc.
500 So. Paulina St., Chicago 7, Ill.
John Hanan

Crescent Electric Supply Co.
765 Iowa St., Dubuque, Iowa
Titus B. Schmid

Crouse-Hinds Co.
Syracuse 1, N. Y. *A. H. Clarke*

Crouse Hinds Co. of Canada, Ltd.
7 Labatt Ave., Toronto, Ont. *F. R. Jeffery*

Curtis Lighting, Inc.
6135 W. 65th St., Clearing Station, Chicago 38, Ill. *Darwin Curtis*

Curtis Lighting of Canada, Ltd.
195 Wicksteed Ave., Leaside, Toronto 12, Ont. *H. L. Wright*

Cutler Light Manufacturing Co.
2026-28 N. 22d St., Philadelphia 21, Pa.
Robert T. Cutler

Dallas Power & Light Co.
1506 Commerce St., Dallas 1, Texas
W. G. Moore

Day-Brite Lighting, Inc.
5401 Bulwer St., St. Louis 7, Mo.
D. J. Biller

The Dayton Power & Light Co.
25 No. Main St., Dayton, Ohio
H. S. Nonneman

Dazor Manufacturing Corp.
4483 Duncan Ave., St. Louis 10, Mo.
P. L. Read

Delaware Power & Light Co.
600 Market St., Wilmington 99, Del.
W. A. F. Pyle

Dept. of Water & Power, City of Los Angeles, Bur. of Power & Light
Box 3669 Terminal Annex, 207 So. Broadway, Los Angeles 54, Calif. *C. P. Garman*

Detroit Edison Co.
2000 Second Ave., Detroit 26, Mich.
L. E. Taylor

Detroit Steel Products Co.
2250 E. Grand Blvd., Detroit 11, Mich.
W. Clifton Randall

E. I. duPont de Nemours & Co., Inc. (Fabrics & Finishes Div.)
Wilmington 98, Del. *S. W. Quisenberry*

E. I. du Pont de Nemours & Co., Inc. Polychemicals Dept.
Wilmington 98, Del. *E. E. Leary*

Duquesne Light Co.
435 Sixth Ave., Pittsburgh 19, Pa.
G. W. Ousler

Duro Test Corp.
2321 Hudson Blvd., North Bergen, N. J.
James L. Cox

Eastern Fixture Co., Inc.
170 Vernon St., Boston 20, Mass.
Louis Gilman

East Side Metal Spinning & Stamping Corp.
1 W. 34th St., New York 1, N. Y.
M. A. Kremer

(*Note*: Names of Official Representatives appear in Italics)

Ebasco Services, Inc.
2 Rector St., New York 6, N. Y.
W. E. Parrett

Electrical Information Publications, Inc.
20 E. Miflin, P.O. Box 232, Madison, Wis.
W. N. Dudley

Electrical Testing Laboratories, Inc.
79th St. & East End Ave., New York City 21, N. Y.
Preston S. Millar

Elec. Service Mfg. Co.
17th & Cambria Sts., Philadelphia 32, Pa.
E. A. Leinroth

Electric Supply Corp.
701 W. Jackson Blvd., Chicago 6, Ill.
L. B. Mangione

Electro Manufacturing Corp.
2000 W. Fulton St., Chicago 12, Ill.
L. K. Schoenbrod

Electroliier Mfg. Company, Ltd.
5849 Boyer St., Montreal, Que., Canada.
John Issenman

Ender Manufacturing Corp.
260 West St., New York 13, N. Y.
Jules Levenstein

Electron Corp.
4501 Galapago, Denver, Colo.
Floyd Vickers

Englewood Electrical Supply Co.
5801-03 So. Halsted St., Chicago, Ill.
Ray O'Leary

Famous Fluorescent Light Co.
762 N. Ogden Ave., Chicago 22, Ill.
Jack R. Stone

Federal Electric Company, Inc.
8700 S. State St., Chicago, Ill.
John H. Goehst

Fitchburg Gas & Electric Light Co.
537 Main St., Fitchburg, Mass.
A. G. Neal

Fluorescent Equipment & Mfg. Co.
2570 Superior Ave., Cleveland 14, Ohio
Leonard S. Freeman

Fluorescent Maintenance Co., Inc.
1480 S. Robertson Blvd., Los Angeles 35, Calif.
Leonard K. Black

Fluores-O-Lite Co.
Evans Terminal, No. Broad St., Hillside, N. J.
Meyer H. Silverman

The Fostoria Pressed Steel Corp.
Fostoria, Ohio
E. L. Bates

H. A. Framburg & Co.
3320-28 Carroll Ave., Chicago 24, Ill.
Stanley A. Framburg

The France Mfg. Co.
10325 Berea Rd., Cleveland 2, Ohio
J. H. Mayne

The Frankelite Co.
1425 Rockwell Ave., Cleveland 14, Ohio
Dave Frankel

Franklin Design Service, Division of Safeway Stores, Inc.
4th & Jackson Sts., P.O. Box 660, Oakland 4.
Wallace H. Lane

The Frink Corporation
27-01 Bridge Plaza North, Long Island City, N. Y.
Theo. J. Brassel, Jr.

Gallagher-O'Brien Electric Co., Inc.
712 N. State St., Chicago 10, Ill.
Frank A. Gallagher

Garden City Plating & Mfg. Co.
1750 No. Ashland Ave., Chicago 22, Ill.
G. G. Harney

General Electric Co., Apparatus Dept.
River Works, 920 Western Ave.,
West Lynn, Mass.
A. F. Dickerson

General Electric Co., Lamp Dept.
Nela Park, Cleveland 12, Ohio
Willard C. Brown

General Electric Supply Corp.
1260 Boston Ave., Bridgeport, Conn.
W. W. Booth

General Lighting Products Co.
468 Frelinghuysen Ave., Newark 5, N. J.
Nathan H. Eglowstein

General Outdoor Advertising Co., Inc.
515 So. Loomis St., Chicago, Ill.
R. E. Nevius

The Georgia Power Co.
Electric Building, Atlanta 1, Ga.
Charles A. Collier

Gibson Manufacturing Co.
1919 Piedmont Circle, N. E., Atlanta, Ga.
R. R. Gibson

Gill Glass & Fixture Co.
Amber & Tioga Sts., Philadelphia 34, Pa.
C. A. Gill

Gillfader Brothers, Inc.
Erie & Liberty Sts., Port Jervis, N. Y.
J. Fletcher Gillfader

Gleason-Tiebout Glass Co.
99 Commercial St., Brooklyn 22, N. Y.
Charles W. Gleason

Globe Lighting Products Co., Inc.
397 Seventh Ave., Brooklyn, N. Y.
Isidor Rosenblatt

Golde Manufacturing Co.
1214 West Madison, Chicago 7, Ill.
E. W. Goldberg

Grand Rapids Store Equip. Co.
1340 Monroe Ave., N. W., Grand Rapids 2, Mich.
Kenneth C. Welch

Graybar Electric Co., Inc.
420 Lexington Ave., New York 17, N. Y.
Raymond C. Kinsey

Gulf States Utilities Co.
Box 2951, Beaumont, Texas
Clarence Barron

The Edwin F. Guth Co.
2615 Washington Ave., St. Louis 3, Mo.
Fred E. Guth

Hartford Electric Light Co.
266 Pearl St., Hartford 3, Conn.
Victor Ouellette

Hawkins Electric Co.
1447 Washington Blvd., Chicago 7, Ill.
R. H. Hill

Hendrickson-Heffernan Co., Inc.
45-17 Pearson St., Long Island City 1, N. Y.
Joseph T. Manucia

Holdenline Co.
2301 Scranton Rd., Cleveland 13, Ohio
H. E. Ingraham

Holophane Company, Inc.
342 Madison Ave., New York 17, N. Y.
H. L. Logan

Home Gas & Electric Co.
810 Ninth St., Greeley, Colo.
C. Gilbert Dresser

Houston Lighting & Power Co.
P.O. Box 1700, Houston 1, Texas
H. O. Clarke

Hydro-Electric Power Comm. of Ont.
620 University Ave., Toronto, Ontario.
R. L. Hearn

Hyland Electrical Supply Co.
700 West Jackson Blvd., Chicago, Ill.
Chas. H. Weicenang

Illinois Power Co.
134 East Main St., (L Box 511 B), Decatur 70, Ill.
Allen Van Wyck

Illuminating Engineering Co.
2347 E. Nine Mile Road, Hazel Park, Mich.
Bert C. Pretzer

Iowa-Illinois Gas & Electric Co.
United Light Bldg., Davenport, Iowa
John M. Hollingsworth

Iowa Public Service Co.
400 Commercial St., Waterloo, Iowa
C. R. Wagoner

Jeannette Shade & Novelty Co.
N. Fourth St., Jeannette, Pa.
H. N. Crock

Jefferson Electric Co.
Bellwood, Ill.
L. Maurer

Jersey Central Power & Light Co.
501 Grand Ave., Asbury Park, N. J.
D. J. Douglas

Joleco Corporation
2513 Baldwin St., St. Louis, Mo.
George Ledbetter

Jones Metal Products Co.
West Lafayette, Ohio
H. Boyer

Joslyn Mfg. & Supply Co.
3700 So. Morgan St., Chicago 9, Ill.
J. H. Fahey

Kahn Manufacturing Co., Inc.
2051 N. 19th St., Milwaukee, Wis.
Charles F. Kahn

Kansas City Power & Light Co.
P.O. Box 679, Kansas City 10, Mo.
John M. Arthur, Jr.

Kansas Gas & Electric Co.
P.O. Box 204, Wichita, Kans.
H. W. Hobson

The Kawneer Co.
North Front St., Niles, Mich.
Richard M. Spray

The Kayline Company
2480 E. 22nd St., Cleveland 15, Ohio
M. A. Eskins

Kelso-Burnett Electric Co.
223 W. Jackson Blvd., Chicago 6, Ill.
Sigmund A. Hollinger

Keystone Electric Manufacturing Co.
2228-36 E. Tioga St., Philadelphia 34, Pa.
Leonard M. Siegel

The Kirlin Company
3435 E. Jefferson Ave., Detroit 7, Mich.
Irvin Kirlin

Kopp Glass, Inc.
Swissvale, Pa.
P. C. Asbo

Kubec Electric Co.
630 W. Jackson Blvd., Chicago 6, Ill.
Fred A. Girten

The La Salle Lighting Products, Inc.
145 Seneca St., Buffalo 3, N. Y.
Nelson R. Zicherman

Leader Electric Manufacturing Corp.
3500 N. Kedzie St., Chicago 18, Ill.
Walter Glass

The Leeds & Northrup Co.
4901 Stenton Ave., Philadelphia 44, Pa.
I. M. Stein

Libbey Owens Ford Glass Co., Plaskon Division
2112-24 Sylvan Ave., Toledo, Ohio
Dr. M. H. Bigelow

Light Control Company
3217 Casitas Ave., Los Angeles 26, Calif.
Stanley E. Lindahl

Lighting & Lamps
114 East 32nd St., New York 16, N. Y.
James Krieger

Lighting Incorporated
1834 So. Figueroa St., Los Angeles, Calif.
Harry Marsh

Lighting Products, Inc.
2259 W. Park Ave., Highland Park, Ill.
D. E. Dunne

Lightolier Co.
11 East 36th St., New York 16, N. Y.
H. Stollnitz

Line Material Co.
Division of McGraw Electric Co.
800 North 8th St., Milwaukee 1, Wis.
M. C. Harsh

Litecontrol Corp.
36 Pleasant St., Watertown 72, Mass.
Paul H. Lamson

Louisiana Power & Light Co.
142 Delaronde St., Station "A," New Orleans, La. *C. L. Osterberger*

Luminator, Inc.
120 N. Peoria St., Chicago 7, Ill.
Albert L. Arenberg

T. R. Lyda Manufacturers Rep.
4922 Washington Blvd., Indianapolis, Ind.
T. R. Lyda

Lynn Gas & Electric Co.
90 Exchange St., Lynn, Mass. *James A. Cook*

Macbeth Corp.
227 West 17th St., New York, N. Y.
Norman Macbeth

Malden Electric Co.
157 Pleasant St., Malden, Mass.
Donald S. Bennett

Markel Electric Products, Inc.
145 E. Seneca St., Buffalo 3, N. Y.
D. L. Ripley

La Cie Martineau Electrique Ltee.
24 rue du Roi, Quebec, Canada
Henri Martineau

Metalcraft Products Company
306-08 Cherry St., Philadelphia 6, Pa.
Alex Abel

Metal Window Institute
Cheltenham, Pa. *George Hingston*

Metropolitan Edison Co.
412 Washington St., Reading, Pa.
E. J. Ingram

Metropolitan Electrical Supply Co.
20 N. Jefferson St., Chicago 6, Ill.
H. J. Privat

Midwest Chandelier Co.
15th & Gentry Sts., No. Kansas City 16, Mo.
Sidney Lefkovitz

The Miller Co.
Meriden, Conn. *G. W. Beals*

Mississippi Glass Co.
200 Fifth Ave., New York City 10, N. Y.
E. H. Hobbie

Mississippi Power Co.
Gulfport, Miss. *E. M. Shearer*

Mississippi Power & Light Co.
Lampton Building, Jackson 113, Miss.
Henry B. Sargent

Mitchell Manufacturing Co.
2525 Clybourn Ave., Chicago 14, Ill.
Bernard Mitchell

Mobilite Inc.
440 Mercer St., Jersey City, N. J.
Sidney Solmor

Modern Light Co.
1512 Pine St., St. Louis 3, Mo.
Karl L. Rundberg

Modern Light & Equip. Co.
3812 S. Wabash Ave., Chicago, Ill.
M. L. Offenberg

Moe-Bridges Corp.
1415 Illinois Ave., Sheboygan, Wis.
M. B. Deutsch

Montana-Dakota Utilities Co.
831 Second Ave. So., Minneapolis 2, Minn.
W. L. Hayes

Municipal Light and Power Dept.
City of Pasadena, California, 302 City Hall, Pasadena 1, Calif. *E. L. Bettannier*

Mutual Sunset Lamp Mfg. Co., Inc.
540 Empire State Bldg., New York 1, N. Y.
Morris Thau

The Narragansett Electric Co.
49 Westminster St., Providence 1, R. I.
C. E. Broadhead

National Chemical & Manufacturing Co. Luminall Paint Div.
3617 So. May St., Chicago 9, Ill.
John Marshall Zir

National Lighting Products
4221 W. Harrison St., Chicago 24, Ill.
D. J. Epp

Nelson-Tombacher Co.
81 Prospect St., Brooklyn, N. Y.
M. J. Tombacher

New Bedford Gas & Edison Light Co.
693 Purchase St., New Bedford, Mass
W. S. Fenstermacher

New Orleans Public Service, Inc.
317 Baronne St., New Orleans, La.
S. L. Drumm

New York Power & Light Corp.
Albany 1, N. Y. *Coburn D. Hollister*

Northern Electric Co. Ltd.
1620 Notre Dame St., West, Montreal, Quebec.
F. P. Labey

Northern Indiana Public Service Co. Gary Div.
500 Broadway, Gary, Ind. *J. C. Sackman*

Northern States Power Co.
Minneapolis 2, Minn. *Carl T. Bremicker*

Ohio Edison Co. (Akron Div.)
Akron 8, Ohio *E. F. Hartenstein*

The Ohio Power Co.
301-315 Cleveland Ave., S. W., Canton 2, Ohio
C. B. Morin

The Ohio Public Service Co.
P.O. Box 6058, Cleveland 1, Ohio.
C. L. Dunn

Oklahoma Gas & Electric Co.
Box 1498, Oklahoma City 1, Okla.
E. W. Gray

Omaha Public Power District
720 Electric Bldg., Omaha 2, Nebraska
E. E. Schwalm

Overbagh & Ayres Mfg. Co.
411 S. Clinton St., Chicago 77, Ill.
Alfred A. Overbagh

Pacific Gas & Electric Co.
245 Market St., San Francisco 5, Calif.
O. R. Doerr

Pacific Power & Light Co.
522 Public Service Bldg., Portland 4, Oregon
C. A. Root

Peerless Electric Ltd.
1090 Pratt Ave., Outremont, Quebec.
L. A. Van Duzer

Wm. Penn Fluorescent Light Mfg. Co.
1639 So. Broad St., Philadelphia, Pa.
William Ranieri

Pennsylvania Electric Co.
535 Vine St., Johnstown, Pa.
Frank R. Knowles

Pennsylvania Power Co.
19 E. Washington St., New Castle, Pa.
P. G. Dingledy

Pennsylvania Power & Light Co.
901 Hamilton St., Allentown, Pa.
J. M. Stedman

Pennsylvania Wire Glass Co.
1612 Market St., Philadelphia 3, Pa.
Dr. Frank W. Preston

The Perfeclite Company
1457 E. 40th St., Cleveland, Ohio
Joseph L. Jaffe, Jr.

Philadelphia Electric Co.
1000 Chestnut St., Philadelphia 5, Pa.
H. B. Bryans

Philadelphia Electrical & Mfg. Co.
1200-36 N. 31st St., Philadelphia 21, Pa.
R. A. Manwaring

Phoenix Glass Co.
Monaca, Pa. *D. G. Cameron*

Pierce Electric Co.
367 West Adams St., Chicago 6, Ill.
John H. Pierce

Pittsburgh Corning Corp.
307 Fourth Ave., Pittsburgh, Pa.
Robert W. McKinley

Pittsburgh Plate Glass Co.
Grant Bldg., Pittsburgh 19, Pa.
R. B. Tucker

Pittsburgh Reflector Co.
403-411 Oliver Bldg., Pittsburgh 22, Pa.
H. C. Zinsmeister

Portland General Electric Co.
Electric Bldg., Portland 5, Ore. *T. W. Fitch*

The Potomac Edison Co.
55 E. Washington St., Hagerstown, Md.
S. S. Bradford

Public Service Co. of Colo.
900 Fifteenth St., Denver, Colo. *G. B. Buck*

Public Service Co. of Indiana, Inc.
110 N. Illinois St., Indianapolis 9, Ind.
G. O. Stewart

Public Service Co. of Northern Illinois
72 West Adams St., Chicago 3, Ill.
G. K. Hardacre

Public Service Co. of Oklahoma
Box 201, Tulsa 2, Okla. *C. N. Robinson*

Public Service Electric & Gas Co.
80 Park Place, Newark 2, N. J.
H. P. J. Steinmetz

Puget Sound Power & Light Co.
860 Stuart Bldg., Seattle 11, Wash.
Frank McLaughlin

The Pyle-National Co.
1334 N. Kostner Ave., Chicago 51, Ill.
T. E. McDowell

Quadrangle Mfg. Co.
32 So. Peoria St., Chicago 7, Ill.
Dwight E. Worrell

Quebec Hydro-Electric Commission
107 Craig St., West, Montreal, Que.
Paul E. Poitras

Quebec Power Co.
229 St. Joseph St., Quebec, Que.
Jean Saint-Jacques

Rambusch Decorating Co.
40 W. 13th St., New York 11, N. Y.
Edward Rambusch

Revere Electric Mfg. Co.
6009-17 N. Broadway, Chicago 40, Ill.
Van N. Marker

Revere Electric Supply Co.
757 West Jackson Blvd., Chicago, Ill.
Floyd Fernau

Rochester Gas & Electric Corp.
89 East Ave., Rochester 4, N. Y.
Frank C. Taylor

Rockland Light & Power Co.
Nyack, N. Y. *D. S. Schaab*

Rohm and Haas Co.
222 W. Washington Sq., Philadelphia 5, Pa.
F. W. Tetzlaff

Ruby-Phillite Corp.
32-02 Queens Blvd., Long Island City 1, N. Y.
Louis Phillips

Rumsey Electric Co.
1007 Arch St., Philadelphia 7, Pa.
T. W. Lauer

Ryall Electric Supply Co.
1160 Stout, Denver, Colo. *C. O. Ryall*

S & M Lamp Co.
119 West 36th Place, Los Angeles 54, Calif.
Jim Shirreffs

The Safety Car Heating & Lighting Co.
P.O. Box 904, New Haven 4, Conn.
Leonard Pierson

St. Joseph Ry., Light, Heat & Power Co.
520 Francis St., St. Joseph 2, Mo.
F. P. O'Connor

Sandee Manufacturing Co.
5050 Foster Ave., Chicago, Ill.
Cortes N. Sprankle

Sandel Manufacturing Co.
3618 So. Loomis Place, Chicago 9, Ill.
A. L. Sandel

San Diego Gas & Electric Co.
P.O. Box 1831, San Diego 12, Calif.
A. E. Holloway

Savannah Electric & Power Co.
Savannah, Ga. *J. L. Davidson*

Schockett Electric Co.
1061 Broadway St., Denver 3, Colo.
Carl Schraus, Jr.

Schomer Electric Supply
164 S. Broadway, Aurora, Ill.
Daniel Schomer

The Scott-Jaqua Co. Inc.
316 Indiana Terminal Warehouse Bldg., Indianapolis, Ind. *C. A. Jaqua*

The Albert Sechrist Mfg. Co.
1717 Logan St., Denver 5, Colo.
K. L. Francis

L. J. Segil Co.
2500 W. North Ave., Chicago, Ill.
Louis Rosenstein

Shawinigan Water and Power Co.
600 Dorchester St., W., Montreal, Que.
J. K. Wilson

The Sherwin-Williams Co.
101 Prospect Ave., N. W., Cleveland 1, Ohio
J. A. Meacham

The Sight Light Corp.
P.O. Drawer C, Deep River, Conn.
E. L. Canfield

Silvray Lighting, Inc.
R. K. O. Bldg., Radio City, New York 20, N. Y. *J. M. Gilbert*

Sioux City Gas & Electric Co.
515 Fifth St., Sioux City 4, Iowa *C. R. Tracy*

A. L. Smith Iron Co.
217 Everett Ave., Chelsea, Mass.
Joseph Fishman

Smoot-Holman Co.
321 No. Eucalyptus Ave., Inglewood, Calif.
L. A. Hobbs

Sola Electric Co.
4633 W. 16th St., Chicago 50, Ill.
L. C. Marschall

Solar Light Mfg. Co.
1357 S. Jefferson St., Chicago 7, Ill.
A. Lazerson

The Solex Co. Ltd.
280 Faillon St., West, Montreal, Que.
Leon Beauchamp

Southern Calif. Edison Co., Ltd.
601 West 5th St., Los Angeles 53, Calif.
G. M. Rankin

Southern Canada Power Co. Ltd.
355 James St., West, Montreal, Que.
George E. Atchinson

Southern Colorado Power Co.
Box 75, Pueblo, Colo.
G. W. Milliken

Southern Indiana Gas & Elec. Co.
P.O. Box 569, Evansville 3, Ind.
C. K. Graham

Southern Lighting Mfg. Co.
P.O. Box 2546, Orlando, Fla.
Max K. Aulick

Southwestern Gas & Elec. Co.
Box 1106, Shreveport, La.
J. E. Elliott

Southwestern Public Service Co.
Amarillo, Texas
J. E. Cunningham

The Spero Electrical Corp.
18222 Lanken Ave., Cleveland, Ohio
Herbert I. Spero

Stanley Electric Mfg. Co.
1234 Carpenter St., Philadelphia 47, Pa.
Bernard S. Holler

Steber Manufacturing Co.
2700 Roosevelt Rd., Broadview, Maywood, Ill.
C. W. Demmon

Steiner Electric Co.
3500 Milwaukee Ave., Chicago 41, Ill.
George S. Steiner

Sterling Reflector & Mfg. Co.
3249 West Grand Ave., Chicago 51, Ill.
Anton Oberhuber

Sunbeam Lighting Co.
777 E. 14th Place, Los Angeles 11, Calif.
Herbert L. Krieger

Sun-Ray Fluorescent Co.
600 South Michigan Ave., Chicago, Ill.
Jerome Gimbel

Sylvania Electric Products, Inc.
500 5th Ave., New York, N. Y.
D. P. Caverly

Tampa Electric Co.
Cass & Tampa Sts., Tampa 1, Fl.
F. J. Gannon

Texas Electric Service Co.
Electric Bldg., Fort Worth 1, Texas
R. E. Hendricks

Thompson Electric Co.
1101 Power Ave. N. E., Cleveland 14, Ohio
Thayer B. Farrington

Toledo Edison Co.
Edison Bldg., Toledo 4, Ohio
Charles A. Harrison

Toronto Hydro-Electric System
14 Carlton St., Toronto 2, Ont.
A. W. J. Stewart

Torstenson Glass Co.
3233 N. Sheffield Ave., Chicago 13, Ill.
Elmer L. Torstenson

Triangle Industries
600 W. Adams St., Chicago, Ill.
Leonard Cohen

Tru-Lite Ltd.
824 Notre Dame St., W., Montreal, Que.
Omer M. Trudel

Underwriters' Laboratories, Inc.
207 E. Ohio St., Chicago 11, Ill.
Ferd. Neumer

Union Electric Co. of Missouri
12th & Locust Sts., St. Louis 1, Mo.
W. L. Berry

Union Metal Mfg. Co.
Canton 5, Ohio *W. A. Porterfield*

The United Illuminating Co.
80 Temple St., New Haven 6, Conn.
E. B. Haskell

United Manufacturing Co.
Div. United Advertising Corp.
190 Whalley Ave., New Haven, Conn.
William R. Harris

Utah Power & Light Co.
Box 899, Salt Lake City 10, Utah
W. A. Huckins

Verd-A-Ray Corp.
615 Front St., Toledo 5, Ohio *O. S. Levi*

John C. Virden Co.
6009-6103 Longfellow Ave., Cleveland 3, Ohio
W. G. Sawyer

John C. Virden, Ltd.
35 Front St., East, Toronto, Ont.
P. G. Kirkpatrick

Virginia Electric & Power Co.
Richmond, Va. *J. G. Holtzclaw*

Voigt Co.
1649 No. Broad St., Philadelphia 22, Pa.
C. J. Frank

The F. W. Wakefield Brass Co.
Vermilion, Ohio *A. F. Wakefield*

The Washington Water Power Co.
P.O. Drawer 1445, Spokane 6, Wash.
Carl L. Hoffman

The Watson Standard Co.
225 Galveston Ave., Pittsburgh 12, Pa.
H. E. Striker

The Welsbach Corp.
1500 Walnut St., Philadelphia 2, Pa.
H. H. Adams

Westchester Lighting Co.
9 South 1st Ave., Mt. Vernon, N. Y.

Westinghouse Electric Corp.
1216 W. 58th St., Cleveland 1, Ohio (P.O. Box 5817) *W. F. White*

Westinghouse Electric Supply Co.
113 North May St., Chicago 7, Ill.
Henry Czech

Westinghouse Lamp Div.
Bloomfield, N. J. *Samuel G. Hibben*

West Penn Power Co.
14 Wood St., Pittsburgh 30, Pa.
Harry Restofski

The Wheeler Insulated Wire Co., Inc.
150 E. Aurora St., Waterbury 91, Conn.
George B. Horn

Wheeler Reflector Co.
275 Congress St., Boston 10, Mass.
K. A. Sawin

Wiedenback-Brown Co., Inc.
111 Eighth Ave., New York 11, N. Y.
W. C. Stockberger

R. & W. Wiley, Inc.
119 Dearborn St., Buffalo 7, N. Y.
H. B. Alderman

H. E. Williams Products Co.
108 S. Main St., Carthage, Mo.
P. B. Williams, Jr.

Wilmot Castle Co.
1255 University Ave., Rochester 7, N. Y.
E. H. Greppin

J. A. Wilson Lighting & Display Ltd.
9 Morrison St., Toronto, Ont. *J. A. Wilson*

The Windsor Utilities Comm., Hydro Div.
149 Chatham St., W., Windsor, Ont.
W. A. Shaw

The Wiremold Company
Hartford 10, Conn. *D. Hayes Murphy*

Wisconsin Electric Power Co.
Public Service Bldg., Milwaukee 1, Wis.
G. W. Van Derzee

Wisconsin Gas & Elec. Co.
100 Third St., Racine, Wis. *J. H. Dunham*

Wisconsin Power & Light Co.
122 W. Washington Ave., Madison 1, Wis.
J. D. Howard

Wisconsin Public Service Corp.
Green Bay, Wis. *A. G. Burr*

Worcester County Electric Co.
11 Foster St., Worcester, Mass.
Fred E. Littlefield

Yonkers Electric Light & Power Co.
9 South 1st Ave., Mt. Vernon, N. Y.

COMMITTEES

COMMITTEES
1949-1950

Except as noted below, all committees are appointed by the President, subject to approval of the Council, and terminate at the time of the first Council meeting each new administration, in the month of October. The duties of each committee are indicated.
C. H. Goddard, President, ex officio member of all committees.

STANDING COMMITTEES

BOARD OF FELLOWS — To evaluate the eligibility of candidates for transfer to the grade of Fellow and recommend their election by Council.
Howard M. Sharp, Chairman, 82 Smallwood Drive, Synder 21, New York
O. P. Cleaver — H. H. Magdsick
W. Harrison — T. W. Rolph
J. L. Stair

COUNCIL EXECUTIVE — To conduct the affairs of the Society between Council meetings.
C. H. Goddard, Chairman, Sylvania Elec. Prods. Inc., 60 Boston St., Salem, Mass.
S. G. Hibben — E. M. Strong
A. H. Manwaring — Walter Sturrock

FINANCE — Direct supervision of the financial affairs of the Society, present annual report on its financial condition and make recommendations to Council as to investments of money and upon all specific appropriations.
C. C. Keller, Chairman, Holophane Co., Inc., 342 Madison Ave., New York 17, N. Y.
G. T. Bogard — E. M. Strong
M. N. Waterman

GENERAL BOARD OF EXAMINERS — Evaluate the eligibility of applicants for admission to membership or transfer to the grade of Member and submit to Council their nominees for election to the grade of Member Emeritus.
E. M. Fahey, Chairman, Public Service Elec. & Gas Co., 80 Park Place, Newark 1, N. J.
B. C. Cooper — Caroline Horn

PAPERS — To procure, review and approve all technical papers and discussions thereof, for presentation before National Conferences of the Society.
Hoyt P. Steele, Chairman, Benjamin Electric Mfg. Co., Des Plaines, Ill.
H. W. Horn, Vice-Chairman, University of Illinois, Urbana, Ill.
R. D. Bradley — K. M. Reid
C. I. Brady — H. L. Wright
P. H. Hildebrand — R. M. Zabel

PUBLICATIONS — To be responsible for the procurement, review and approval of all material for the publications of the Society other than technical papers approved by the Papers Committee for presentation at National Conferences of the Society and their discussions, and committee reports, for which it will have publication responsibility only. Shall also be responsible for the editing, printing and business management of the publications of the Society.
E. C. Huerkamp, Chairman, Westinghouse Elec. Corp., 1216 W. 58th St., Cleveland 1, Ohio
J. M. Stedman, Vice-Chairman, Pennsylvania Power & Light Co., Allentown, Pa.
H. H. Magdsick — R. G. Slauer
R. W. Staud

Sub-Committee on Advertising Sales
R. W. Staud, Chairman, Benjamin Electric Mfg. Co., Des Plaines, Ill.

Sub-Committee on Editorial Content
H. H. Magdsick, Chairman, General Elec. Co. Nela Park, Cleveland 12, Ohio

Sub-Committee on Publication Sales and Distribution

Sub-Committee on Home Lighting Data Sheets
Mary B. Taepke, Chairman, Detroit Edison Co., 2000 Second Ave, Detroit 26, Mich.
Jacob H. Blitzer — Margaret Fenner
Edith Buchholtz — Stella Fetzer
F. P. D'Esopo — Anthony Fodell
Mary Dodds — Ruth Morris
Lillian Eddy — Aileen Page
Jan Reynolds

Sub-Committee on Technical Data Sheets
H. P. Scott, Chairman, McGraw-Hill Publishing Co., 330 W. 42nd St., New York 18, N. Y.

GENERAL COMMITTEES

ADVISORY BOARD ON COMMITTEE PERSONNEL — To examine the organization, accomplishments, and assignments of committees and prepare not later than June 1st of each year a proposed list of committees and personnel.
Walter Sturrock, Chairman, General Electric Co., Nela Park, Cleveland 12, Ohio
C. L. Crouch — R. W. Staud
C. H. Goddard — L. E. Tayler
A. D. Hinckley — J. F. Whitehead, Jr.

BOARD OF NOMINATION — To prepare a nomination ticket containing the names of those who are deemed best suited to serve as officers and directors in positions to be filled at the ensuing election.
G. K. Hardacre, Chairman, Public Serv. Co. of No. Ill., 72 W. Adams St., Chicago 3, Ill.
R. W. Staud — L. E. Tayler

CONSTITUTION AND BY-LAWS — To prepare for Council amendments to the Constitution and By-Laws, as required, and to develop rules of procedure for the operation of the Society.
R. W. Corwin, Chairman, Benjamin Elec. Mfg. Co., 230 W. 17th St., New York 11, N. Y.
A. A. Brainerd — L. H. Graves
D. P. Caverly — S. R. McCandless

COORDINATING COMMITTEE FOR DEFENSE — To contact various Government Agencies concerned with National Security suggesting cooperation and participation in specific projects as an aid to solution of their problems. Recommending the placement of lighting study projects in present committees or the appointment of study project committees to the Society President and to expedite such study projects and guide accepted reports into proper Governmental channels.
A. F. Wakefield, Co-Chairman, F. W. Wakefield Brass Co., Vermilion, Ohio
Major G. D. Mills, Co-Chairman, 283 Osborne Ave., Brittania Heights, Ottawa, Ont., Canada
O. P. Cleaver — H. R. Jones
C. L. Crouch — Paul Manchester
S. L. Drumm — G. F. Mudgett
G. A. Fry — W. Sturrock
M. N. Waterman

HISTORICAL — To assemble and make available for current reference and to prepare in suitable and durable form for posterity, such historical facts, printed memorabilia, photographs, voice records, museum specimens and allied items as may be judged worthy of composing a continuing digest of the record of the Society's history.
S. G. Hibben, Chairman, Westinghouse Elec. Corp., Bloomfield, N. J.
H. B. Dates — George Ainsworth
V. Lansingh — G. G. Cousins
Mrs. W. F. Little, Librarian — L. H. Graves
G. H. Stickney
L. E. Tayler

LIGHTING SERVICE — To stimulate the discussion and practical application of lighting recommendations, standards, test procedures and other technical and scientific data developed by the Society to regional and local committees and to conduct a Lighting Service Forum in connection with the National Technical Conference.
H. H. Green, Vice-Chairman, General Electric Co., Nela Park, Cleveland 12, Ohio
R. W. Butts — Philip Peeples
Maxwell Cole — W. A. Stannard
R. R. Enghouser — H. A. Stroud
M. A. Havenhill — C. R. Tracy
H. Leland Holtman — L. C. Twichell
H. G. Hrivnatz — John Walsh
F. E. Mueller

LOCAL ACTIVITIES — To coordinate regional and local activities with the national program of the Society, assist Section and Chapter officers with local operating problems, conduct Local Activities Conferences, prepare plan to give members a better understanding of the Society, review applications for the establishment of new Sections and Chapters and recommend the appointment of local representatives.
S. G. Hibben, Chairman, Westinghouse Electric Corp., Bloomfield, N. J.
E. E. Ackland — G. F. Dean
G. W. Beals — E. H. Lauth
J. B. Browder — J. S. Schuchert
F. A. Covington — T. H. Shepherd
W. A. Stannard

MEDAL AWARD — To consider qualifications of candidates for I.E.S. Medal; submit recommendations to Council and prepare citation for the award.
G. K. Hardacre, Chairman, Public Serv. Co. of No. Illinois, 72 W. Adams St., Chicago 3, Ill.
G. W. Beals — J. L. Stair
W. C. Brown — R. W. Staud
G. G. Cousins — L. E. Tayler
L. H. Graves — D. M. Warren

MEMBERSHIP COMMITTEE — To develop plans and supervise the operation of the individual membership campaign in the Society.
Garlan Morse, Chairman, Sylvania Elec. Prods. Inc., 111 Sutter St., San Francisco 4, Calif.
J. H. Hull, Vice-Chairman, Fostoria Industrial Service, 222 Davidson Bldg., Des Moines 9, Iowa
George Bogard, Vice-Chairman, General Electric Co., 570 Lexington Ave., New York, N. Y.

Section and Chapter Representatives
E. A. Adams — W. J. Dorrans
Nick Ball — A. Flechsig
J. W. Bigley — Nels Fugelsang
Carl R. Bisch — W. A. Gale
Frank E. Brown — Howard W. Grosh
Robert D. Carlen — H. L. Guiney
E. J. Copland — Herschel B. Hall
M. J. Cote — James H. Hull
Robert J. Diefenthaler — A. H. Johnson

R. C. Lambert — Clay C. Rittenhouse
H. A. Lawrence — C. T. Roberts
Henry G. Lehl — Alton P. Rose
Harold G. Linder — Lon E. Russell
T. R. Lyda — Joseph J. Sanders
D. J. McKenzie — C. J. Selby
H. J. Mazur — C. C. Shotwell
S. W. McKnight — C. E. Smith
Jay Meara — W. A. Sparks
John E. Metzenthin — Ralph H. Spaulding
C. Leon Moyer — Fred P. Walter
John T. Parks — Eugene West

NATIONAL TECHNICAL CONFERENCE — To supervise the 1950 Technical Conference, select the time and place for the 1951 and 1952 Technical Conferences and act as a depository of invitations for future conferences; study and report to Council the possibility of holding periodically a nationally sponsored technical conference for the Pacific Coast Zone.

R. F. Hartenstein, Chairman, Ohio Edison Company, Akron 8, Ohio
R. W. Butts, Vice-Chairman, The Ohio Public Service Co., 405 Broad St., Elyria, Ohio
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R. R. Brady — D. W. Prideaux
Harry G. attan, Jr. — T. H. Shepherd
A. D. Hinckley — A. E. Simpson
K. E. Hollingsworth — H. P. Steele
C. C. Keller — L. W. Towner
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Leonard Hobbs — Leonard Towner
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PROCEDURES AND POLICIES — Analyze for Council current procedures and policies and make recommendations.

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R. R. Brady — L. E. Tayler
Ward Harrison — A. F. Wakefield
D. M. Jones — J. F. Whitehead

PROFESSIONAL REQUISITES — To study and report on requisites for defining and improving the Professional Status of Illuminating Engineers, especially in reference to Society membership.

R. L. Biesele, Jr., Chairman, Southern Methodist University, Dallas, Texas
J. B. Browder — H. L. Logan
B. C. Cooper — E. M. Strong
W. H. Kahler — L. E. Tayler
Aksel Knudstrup — D. E. Trefry
F. I. Wilson

PROJECT PLANNING — To study the operations, program and policies of the Society with the view of its immediate and long-range objectives and recommend to Council new projects and programs to be established.

J. F. Whitehead, Chairman, Daybrite Lighting Corp., 5411 Bulwer Ave., St. Louis 7, Mo.
S. G. Hibben — R. C. Kinney
B. J. Jensen — N. D. Macdonald
D. M. Jones — W. F. White

PUBLC RELATIONS AND INFORMATION — To prepare and disseminate information about the activities, accomplishments, programs, objectives and policies of the Society and about the place of illuminating engineering in modern society; to formulate and submit public relations policies and plans for the Society.

J. S. Schuchert, Chairman, Duquesne Light Co., 435 Sixth Ave., Pittsburgh 19, Pa.
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RESEARCH FUND COMMITTEE

L. E. Tayler, Chairman, Detroit Edison Co., 2000 2nd Ave., Detroit, Mich.
A. H. Manwaring — R. A. Staud
S. B. Williams

RESIDENCE LIGHTING FORUMS — To reactivate and expand residence lighting forums, suggest programs for meetings, revise Guide for Residence Lighting Forums and conduct a National Residence Lighting Forum Conference in connection with the National Technical Conference.

Priscilla Presbrey, Chairman, Westinghouse Elec. Corp., Bloomfield, N. J.
Mary E. Dodds — Florence O'Donnell
G. I. Dwinell — Florence I. Patterson
Lillian E. Eddy — Jan Reynolds
Myrtle Fahsbender — Margaret Salter
Caroline E. Horn — Mary Taepke
Ruth Morris — Mary E. Webber

SECTION AND CHAPTER PROGRAMS, COORDINATING COMMITTEE ON — To make a study of the subjects and topics of probable interest to our members, review previous section and chapter programs, and prepare a report of program suggestions for section and chapter meetings, technical forums and study clubs.

Carl A. Basedow, Chairman, 742 Ottawa, Park Ridge, Ill.
C. L. Amick — R. R. Lusk
J. R. Chambers — C. D. Miller
J. L. Kilpatrick — C. B. Pederson
G. E. Korten — C. C. Shotwell
R. E. Worstell

SUSTAINING MEMBERSHIP — To obtain additional Sustaining Members.

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R. N. Green — Lester T. Wilcox
W. F. Greenslade, Jr. — Walter N. Wildeman
Horace L. Guiney — Howard L. Wright
R. C. Zinsmeister

TASK COMMITTEES

TASK COMMITTEE — JOINT I.E.S.-A.P.H.A. COMMITTEE — To discuss with A.P.H.A. objectives of mutual interest in illumination, to review the relationship of light and vision, to study a rational basis for the quality and quantity of illumination and develop a list of researches desirable for further knowledge and cooperative effort.

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L. E. Barbrow — C. L. Crouch
Glenn A. Fry

A.P.H.A. Representatives

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C. C. Keller — Walter Sturrock

TASK COMMITTEE ON CONFERENCE WITH THE NATIONAL COUNCIL FOR SCHOOLHOUSE CONSTRUCTION — To explore the field of mutual interest; to serve as a clearing house of expression regarding reports of both organizations; to study recommendations of quantity and quality of illumination and to develop a suggested program of study and research on specific illumination problems applying to schools.

R. C. Putnam, Chairman, 2223 S. Overlook Rd., University Center Station, Cleveland 6, Ohio
L. H. Brown — W. V. C. Foulks
C. L. Crouch — L. B. Paist

TECHNICAL COMMITTEES

AVIATION LIGHTING — To study the application of light and lighting to the spaces and functions involved in the operation of aircraft.

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R. C. Blatt, Vice-Chairman, Electrical World, McGraw-Hill Publishing Co., 330 West 42nd St., New York 18, N. Y.
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COLOR AND ILLUMINATION — To study, evaluate and report on the effect of color in relation to the art and science of illumination.

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DAYLIGHTING — To study the problems involved in daylighting, develop recommended practices and report thereon.

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FARM BUILDINGS AND WORK AREA LIGHTING — To study the application of light and lighting of farm buildings, surrounding work areas and other rural locations and to report thereon.

O. D. Hunt, Chairman, Kansas State College, Manhattan, Kan.

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Edith Buchholtz	Arthur Kramer
J. P. Ditchman	Joseph Schaenzer

A. J. Von Burg

HANDBOOK REVISION — To revise and arrange the technical content of the Handbook; to lay out, plan and arrange for development of individual sections primarily through appropriate technical committees; to establish and maintain liaison with the Publications Committee with reference to production matters and the preparation of a budget which will be submitted by the Publications Committee to Council for approval; to be responsible to Council for the technical accuracy and treatment of material to be turned over to the Publications Committee for publication.

B. J. Jensen, Chairman, Pub. Serv. Elec. & Gas Co., 80 Park Place, Newark 1, N. J.

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ILLUMINATION PERFORMANCE RECOMMENDATIONS — To prepare illumination performance recommendations for luminaires conforming to I.C.I. classifications, excluding residential.

J. F. Parsons, Chairman, Buffalo Niagara Electric Corp., Buffalo 3, N. Y.

B. S. Benson, Jr.	W. F. Little
S. K. Guth	R. S. Rogge
W. H. Kahler	R. P. Teele

G. P. Wakefield

INDUSTRIAL LIGHTING — To revise the 1942 "American Recommended Practice of Industrial Lighting" with full consideration to the brightness approach, and with Council approval, to submit for American Standards Association approval.

W. C. Brown, Chairman, General Electric Co., Nela Park, Cleveland 12, Ohio

E. A. Linsday, Secretary

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L. H. Brown	C. C. Shotwell
W. H. Kahler	H. P. Steele
Harry Keene	M. N. Waterman

LIGHT CONTROL AND EQUIPMENT DESIGN — Collect and correlate the knowledge and data on means and methods of controlling, directing, reflecting, transmitting, and diffusing light and on the principles and practices of equipment design.

F. C. Winkler, Chairman, Westinghouse Elec. Corp., 1216 W. 58th St., Cleveland 1, Ohio

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B. S. Benson, Jr.	Franklin M. Neal
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LIGHT SOURCES—To correlate and report available information as to the physics of light and light production and the characteristics of current light sources.

E. F. Lowry, Chairman, Sylvania Elec. Prods. Inc., 60 Boston St., Salem, Mass.

E. H. Raddin, Vice-Chairman, 18 Smith Rd., Saugus, Mass.

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E. H. Salter

LIGHTING AND AIR CONDITIONING — To study the relationship between lighting and various factors that enter into air conditioning and report thereon.

E. H. Salter, Chairman, Electrical Testing Laboratories, Inc., 2 East End Ave. & 79th St., New York, N. Y.

Samuel Adams Bogen	R. R. Lusk

H. M. Sharp

Representatives of American Society of Heating and Ventilating Engineers

M. C. Beman	J. N. Livermore

G. B. Priester

LIGHTING AND ARCHITECTURE — To study the application of light and lighting in the field of architecture. To plan an interchange of knowledge and data between the architectural profession and the I.E.S. To plan and develop lighting design competitions in architectural schools. To report to the Society on assignments falling within this scope.

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Edmund F. Wilson

LIGHTING DESIGN PRACTICE — To study published data on coefficients of utilization, room indexes, maintenance coefficients and other elements entering into calculations for lighting design, develop standard methods for use in Society publications and report thereon.

C. L. Amick, Chairman, General Electric Co., Nela Park, Cleveland 12, Ohio

Neal Jacobus, Vice-Chairman, Sylvania Electric Products, Inc., Ipswich, Mass.

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J. R. Jones	R. S. Rogge
J. O. Kraehenbuehl	E. H. Salter

LIGHTING EDUCATION — To prepare educational and training programs on the fundamentals of illumination, lighting design problems and advance theories of light and lighting application. To prepare required text material and to further their adoption locally.

C. D. Miller, Chairman, Duquesne Light Co., 435 Sixth Ave., Pittsburgh 19, Pa.

C. E. Weitz, Vice-Chairman, General Electric Co., Nela Park, Cleveland 12, Ohio

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Don Ingwersen	Tula Salpus

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R. E. Ligare	A. A. Sobolik

LIGHTING OF CENTRAL STATION PROPERTIES—To study and report on the lighting of electric power generating plants and their power distribution facilities.

A. A. Brainerd, Chairman, Philadelphia Elec. Co., 900 Sansom St., Philadelphia 5, Pa.

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G. P. Wakefield

LIGHTING STUDY PROJECTS IN EDUCATIONAL INSTITUTIONS—To study the application of light and lighting to the spaces and processes involved in educational institutions and to report thereon.

R. C. Putnam, Chairman, 2223 S. Overlook Rd., University Center Station, Cleveland 6, Ohio

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Grace C. Hamman	Paul Seagers

N. E. Viles

LIGHTING STUDY PROJECTS IN INDUSTRY—To initiate, follow up and coordinate lighting study projects in the industrial field, review the reports of the various subcommittees in this field and make recommendations to Council.

E. W. Fowler, Chairman, Buffalo Niagara Electric Corp., Buffalo, N. Y.

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C. E. Egeler	R. G. Slauer
C. D. Hollister	M. N. Waterman

Lighting in Bakeries

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S. H. Hazleton, Jr.	Robert Thallon
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Lighting in the Fluid Milk Industry

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Lighting in Foundries

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B. J. Jensen	George H. Scherer
W. G. Morrison	R. W. Stanley

Lighting for the Printing Industry

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Peter Backer	V. P. Scheidt
R. R. Bransdorf	B. J. Taymans

H. M. White

Lighting in Sheet Metal, Stamping, Folding and Shearing

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E. L. Frase	Ted Rougly

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Carlton Ostrom

Lighting in the Textile Industry

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Walter P. Rayner	F. J. Vorlander, Jr.
J. M. Shute	J. E. Watkins

LIGHTING STUDY PROJECTS IN PUBLIC BUILDINGS AND PRIVATE INSTITUTIONS—To initiate, follow up and coordinate lighting study projects in the field of public buildings and private institutions, review the reports of the various study subcommittees in this field and make recommendations to Council.

R. S. Rogge, Chairman, Miller Co., Meriden, Conn.

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Thomas Coghlan	J. L. Kilpatrick
J. R. Jones	C. C. Shotwell

Lighting in Auditoriums and Churches

David H. Mason, Chairman, Mason & Basedow, 1415 W. Adams St., Chicago 7, Ill.

Louis Gold	Edward Rambusch
W. Kennedy	A. C. Sangster

Lighting in Hospitals

Howard Haynes, Chairman, General Electric Co., Nela Park, Cleveland 12, Ohio

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W. J. Engle	Albert Zack

Lighting in Hotels

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Francis Keally	Gladys Miller

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Lighting in Theatres

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S. G. Hibben	George Smedberg
Edward B. Kirk	Daniel Staeble
Herbert Kliegl	R. Gillespie Williams

Frederick M. Wolff

NOMENCLATURE—To define the terms and standards of illumination; and endeavor to obtain uniformity in nomenclature.

Harris Reinhardt, Chairman, Sylvania Elec. Prods. Inc., 500 Fifth Ave., New York 18, N. Y.

J. O. Kraehenbuehl, Vice-Chairman, University of Illinois, Urbana, Ill.

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H. P. Gage	M. Luckiesh
K. S. Gibson	A. E. Parker
L. A. Jones	Priscilla Preabrey

H. P. Steele

OFFICE LIGHTING—To study the lighting requirements of office lighting tasks, develop suitable lighting recommendations and report thereon.

G. P. Wakefield, Chairman, F. W. Wakefield Brass Co., Vermilion, Ohio

G. F. Dean, Vice-Chairman, Toronto Hydro-Electric System, 14 Carlton St., Toronto, Ont., Canada

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George J. Taylor	R. L. Zahour

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W. C. Granville	William Trott
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Project Committee on Performance of Lighting Systems

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Project Committee on Recommendations for Specific Areas

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Project Committee on Task Evaluation

R. L. Oetting, Chairman, General Electric Co., Nela Park, Cleveland, Ohio

George J. Taylor

PROGRESS—To keep in touch with developments in the art of lighting throughout the world and prepare a yearly review of achievements in the art of illuminating engineering for inclusion in ILLUMINATING ENGINEERING.

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J. M. Howard	A. H. Taylor

PUBLIC CONVEYANCES — INTERIOR LIGHTING — To study the application of light to all public areas in conveyances used for passenger transportation, including particularly trains, buses, ships, street railways and subways and report thereon.

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Charles I. Brady	J. L. Heine
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Randolph Whitefield

RESEARCH COMMITTEE — To survey and report on all significant research dealing directly or indirectly with the application of light and lighting and its effect upon the performance and comfort of human beings not conducted by the I.E.S. Research Trust Fund, to survey the whole field of lighting to determine and report on subjects which require scientific verification through research, and to coordinate various types of research affecting lighting which are now being conducted by various agencies.

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RESIDENCE LIGHTING — To study the application of light and lighting to the home, including the study of the aesthetic phase of residential lighting, to prepare some practical reference for good lighting practices in period interiors and to report thereon.

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Norman Vacha

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Sub-Committee on Cooperation with Residence Fixture Manufacturers

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Sub-Committee on Lighting and Viewing Habits Associated with Television Receivers in the Home Survey

Mary E. Dodds, Chairman, Toledo Edison Co., Edison Bldg., Toledo 4, Ohio

Study Projects for Undergraduate Students

Thomas S. Kelly, Chairman, Thomas S. Kelly Lighting, 115 E. 60th St., New York 22, N. Y.

SPORTS AND RECREATIONAL AREA LIGHTING — Develop current recommended practices for lighting sports and recreational areas; study techniques of application including effects on player performance and spectator visibility, and report thereon.

R. J. Swackhamer, Chairman, General Electric Co., 920 Western Ave., Lynn, Mass.
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STANDARDS OF QUALITY AND QUANTITY FOR INTERIOR ILLUMINATION — To prepare standards for illumination levels, brightness limits, brightness ratios for interiors including specific visual tasks, as well as the general surroundings.

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STORE LIGHTING — To study the application of light and lighting to the spaces and processes involved in the selling of goods and to report thereon.

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Lowell, Mass.—Frank H. Jones, The Lowell Electric Light Corp.

New Britain, Conn. — Timothy J. Clare, 376 Chestnut St.

New Haven, Conn. — Fred R. West, Westinghouse Electric Corp.

Norwalk, Conn. — H. A. Hutchinson, Connecticut Light & Power Co.

Pawtucket, R. I. — Walter L. Kelley, Jr., 77 Bayley St.

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Santa Fe, N. M.—Marvin McIntyre, Box 1034
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PRIZES FOR UTILITY, WHOLESALE AND FIXTURE SALESMEN; ARCHITECTS; CONTRACTORS; RETAILERS; BUILDERS; CONSULTANTS!

Select your entries now for General Electric's big Planned Lighting Contest!

YOU'RE eligible for as much as $250 in cash prizes if you've helped with a Planned Lighting job using General Electric lamps in 1949!

Awards will be made on 36 commercial, industrial and residential installations; and each award carries several $100 prizes for those helping to plan, sell, supply and install the lighting—192 cash prizes in all! In addition, the person sending in the report on the winning job receives an *extra* $150. Winners will be chosen from cities in three population classes; and judging will be based on how well the installation did the desired job for the user.

All entries must be in the mail no later than January 31, 1950, so get yours ready right away. If you don't already have the rules for G.E.'s Planned Lighting Awards, call your local General Electric Lamp Department office.

You can put your confidence in—

GENERAL ELECTRIC

Is your lighting reference Library up-to-date?

Many Society members, and non-members too, are making use of the new I.E.S. Lighting Data binder and Series XIV Lighting Data sheets for a compact field and office manual of the latest in lighting application information.

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Inexpensive . . .
Durable . . . . .
Attractive . . .

The binder is a handsome addition to any reference shelf or to any desk. It is made of tough, durable blue fabrikoid material, stamped in gold, yet costs no more than a standard binder. The binder is sturdy enough to last for years in field or office use, and rings are big enough to carry Series XIV sheets and more.

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Use the convenient order form below to become a regular subscriber to Series XIV with the new binder.

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The Cascade Locks School, Cascade Locks, Oregon

Light — ample floods of well-directed light — is a *must* in the design of a successful interior whether it's a schoolroom, office, store or showroom. Which is why it will pay you to discuss that next job with Litecontrol Engineers. They are specialists in properly selecting and combining fixtures. They know how to best provide just the right amount of light in the right places — unobtrusively, inexpensively. And they'll be glad to share that know-how with you — help you produce the type of outstanding interior you want.

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Electrical Engineer: Ray W. Preston.
Lighting Equipment: Litecontrol No. 12F-V30S, recessed fixtures with Holophane CONTROLENS* and square glass prismatic Holophane reflector.
Fixtures per Classroom: 9 in work area, plus 2 in play area at rear.
Lamps: 300 watts per fixture.
Watts per square foot: 5.4.
Footcandles: 33 (average) on desktops.
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WRITE FOR FREE BOOKLET!

Contains: Pictorial Index for easy, quick reference. Complete descriptions and specifications on all Litecontrol fixtures, including utilization factors, formulae and all data necessary to figure an installation from start to finish.

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KEEP UPKEEP DOWN

DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS

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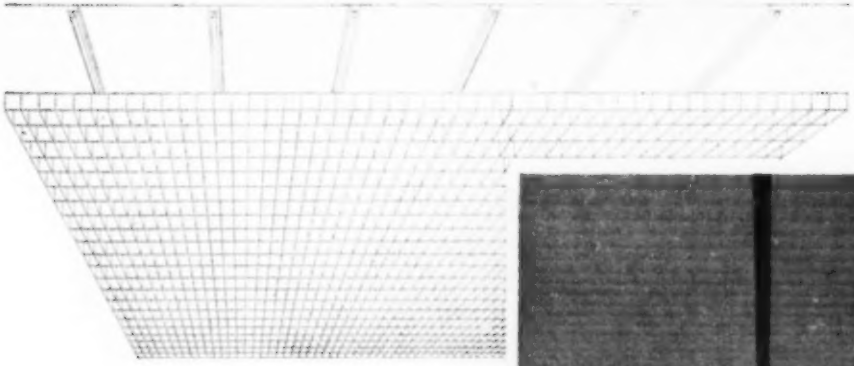

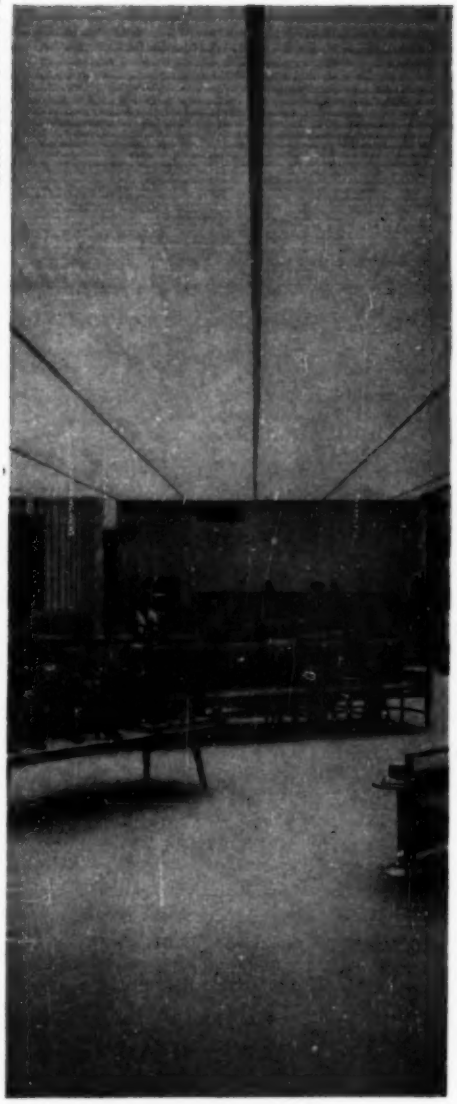

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Cut Lamp Maintenance Time

Check these maintenance features they're the features your customers want

- **Safety** . . . Hazard of falling lamps is virtually eliminated.
- **Convenience** . . . Lamps can be installed from either end of fixture with one fast, easy motion.
- **Economy** . . . Turrets can take hard, rough handling without being damaged . . . costly replacement problems are eliminated.
- **Efficiency** . . . When fixtures have Turrets, lamps are not staggered but mounted in a straight line, thus giving maximum efficient, shadowless lighting.

Check these manufacturers' features they're the features you want in your fixtures

- **Easy to mount** . . . Turrets can be mounted with two screws on any flat surface, preferably with lock washers under screw heads. Starter receptacles are located between the lamps.
- **Easy to wire** . . . Stripped and tinned leads can be inserted through the entrance holes in the face of the Turret lampholder. Binding screws are then tightened through the holes in bottom of the lampholder to make permanent pressure contacts.
- **Easy to design in** . . . Turret lampholders can be used in a wide variety of arrangements. They can be mounted singly or in multiple groups. They are available to accommodate two or three lamps.
- **Easy to sell** . . . The pleasing design of Turret lampholders adds to the appearance and the value of any fluorescent lighting fixture. And don't forget, the confidence inspiring General Electric name helps in the sale of any product.

For further information, write to Section Q56-1257, Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut.

Now for Slimline lamps

Now, General Electric makes Twin Turret lampholders for two 96-inch Type T-12 Slimline lamps. These new Slimline Turrets have all the big features of the standard line of Turrets.

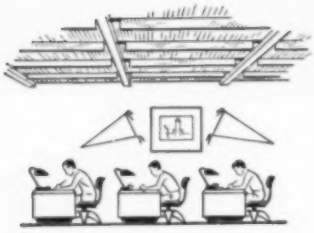
The slow process of replacing lamps with two hands is out when fixtures are equipped with General Electric Turret lampholders.

There are no clips or safety gadgets to fuss with when your fixtures are equipped with Turrets. Snug fit and uniform spring tension hold lamp securely in place—automatically keep firm contact.

Now, lamp changing is a fast, easy, one-hand operation. And there's no need to worry about breaking lampholders, because Turrets are sturdy, can take rough handling.

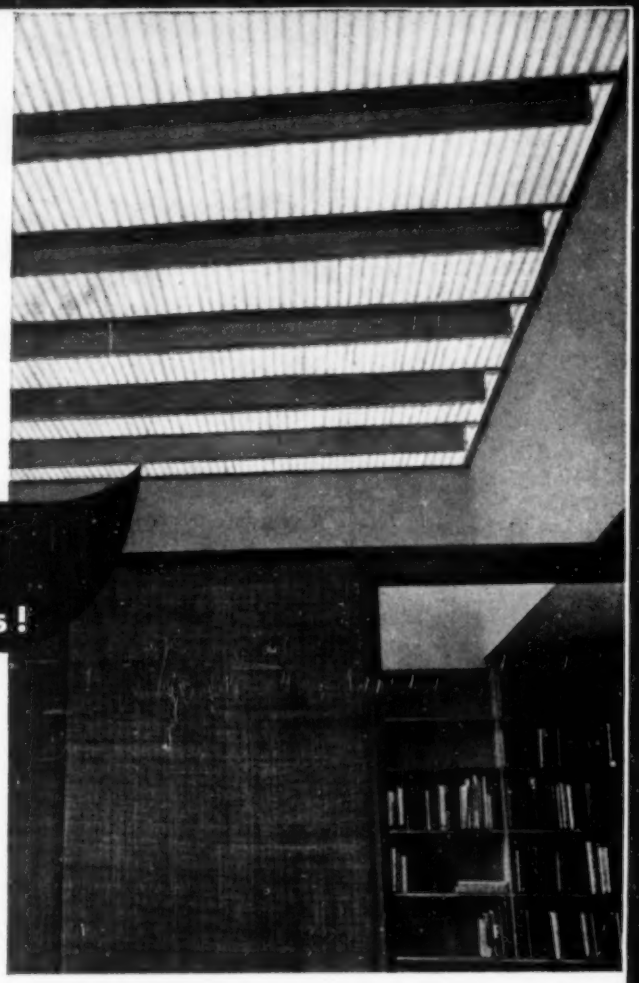
This spring action is the secret of the Turret's simplicity of operation. To insert lamp just push in contact plate and turn lamp slightly to seat pins. Swing free end of lamp up and lamp slides firmly into place.

GENERAL ELECTRIC



Quality Lighting at M.I.T. with

PLEXIGLAS Wall-to-Wall Lighting Fixtures!



PLEXIGLAS has brought a new development to large-area lighting —complete wall-to-wall *illumination without glare or shadows.*

In a typical installation at Massachusetts Institute of Technology, panels of corrugated white translucent PLEXIGLAS suspended below fluorescent lighting, provide glare-free, shadow-free lighting throughout the Provost's office. The acrylic plastic sheets rest on angle irons from which extend acoustical fins.

Actually, large PLEXIGLAS panels, installed wall-to-wall, diffuse light so perfectly that shadows and glare simply vanish. Brightness ratios are amazingly low. Eye-strain is eliminated. And at the same time overhead safety is increased and maintenance costs go down because PLEXIGLAS is light, strong, shatter-resistant.

Quality lighting is essential for schools, offices, public buildings—wherever optimum illumination is desired with no direct or reflected glare. We'll be glad to send you full information on how to solve your lighting problem with PLEXIGLAS lighting fixtures. Just write on your letterhead.

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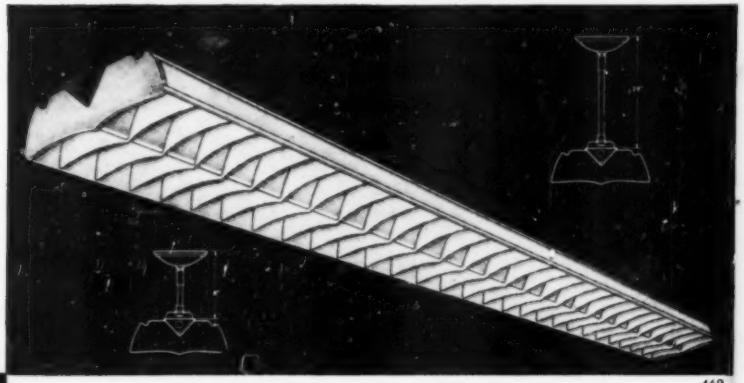
DAY-BRITE'S LUVEX

NEW!



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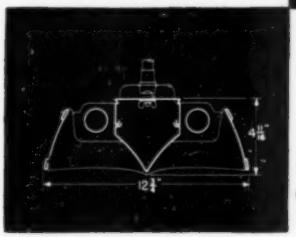
For two 96" T-12 Slimline lamps, single unit or continuous installations. For suspension mounting, listed with 8" and 28" "A-J" Adjustable hangers.



"DECIDEDLY BETTER" SLIMLINE

Once in a blue moon, a truly great fixture makes its appearance. Now, after years of research and designing, the matchless new Day-Brite "LUVEX" is ready.

All the usual advantages of Slimline, of course — instant starting . . . extremely high efficiency.

But then, add these "LUVEX" extras—sturdy, *no-sag*, heavy gauge steel chassis, *enclosure and louvers completely interlocked into a rigid one-piece unit*, quick, easy installation and smart appearance—and the "LUVEX" is absolutely *everything* you expect of Slimline lighting.

Maintenance? *Simple!* So simple, in fact, that the "LUVEX" can be relamped and cleaned without disturbing a single part of the fixture—without so much as touching a latch, chain, nut or bolt!

Get the full "LUVEX" story. It will pay you to know all the facts about this remarkable new Day-Brite development. Write today for Bulletin 10-M.

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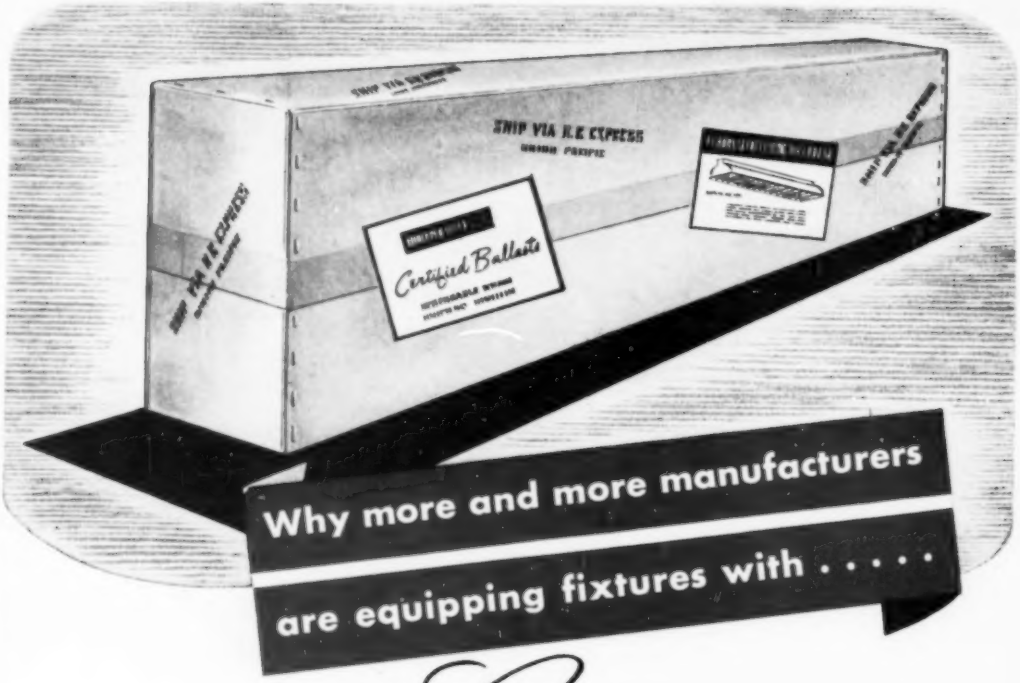
Distributed nationally by leading electrical wholesalers
Day-Brite Lighting, Inc., 5432 Bulwer Ave., St. Louis 7, Mo. In Canada: Amalgamated Elec. Corp., Ltd., Toronto 6, Ontario



Why more and more manufacturers are equipping fixtures with . . . . .

CERTIFIED BALLASTS

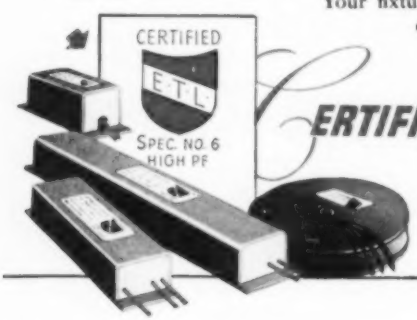
● Do customers complain that fluorescent tubes in your fixtures seem to burn out too soon? Perhaps the trouble lies in the ballast that operates them.

One of the advantages of CERTIFIED BALLASTS is that they assure *Full Lamp Life.* Leading fluorescent tube manufacturers recognize that CERTIFIED BALLASTS in a fixture are evidence that full rated tube life should result.

Other worthwhile advantages of CERTIFIED BALLASTS include: *Rated Light Output* and *Long Dependable Performance.*

CERTIFIED BALLASTS are made to exacting specifications, then tested and certified by Electrical Testing Laboratories, Inc., an impartial authority, to assure best operation of tubes and ballasts.

Your fixtures sell more readily—give greater customer satisfaction—when they are equipped with CERTIFIED BALLASTS.



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Makers of Certified Ballasts for Fluorescent Lighting

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A Permaflector Lighting Portrait

GIMBELS · PITTSBURGH

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The Trimble Co., General Contractors
C. W. Carter Elec. Construction Co.
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Here, in Gimbels newly designed first floor, fluorescent and incandescent silvered-glass Permaflectors produce "light for selling." Dramatic yet functional illumination is achieved with the 203 combination, ceiling recessed, fluorescent-incandescent units.

To transfer your creative lighting designs from "blueprint" to reality is relatively simple when you specify Pittsburgh Permaflector Lighting Equipment. Pittsburgh Reflector Company has the equipment and know-how required to give you efficient, economical illumination that exactly fills your needs—whether your plans call for fluorescent or incandescent light or a combination of both. You will find it worthwhile to discuss your problems with Pittsburgh Permaflector Engineers. Why not call or write today?

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MANUFACTURERS OF FLUORESCENT & INCANDESCENT LIGHTING EQUIPMENT

Permaflector Lighting Engineers in All Principal Cities

PITTSBURGH PERMAFLECTOR LIGHTING EQUIPMENT IS DISTRIBUTED BY BETTER ELECTRICAL WHOLESALERS EVERYWHERE

NEW, Revolutionary Luminous Ceiling; Low-Cost, Scientifically Perfect Lighting

NEW MARTIN ELECTRIC PRODUCT EASY TO INSTALL; ELIMINATES REFLECTED GLARE

Luminous ceilings will provide the light of the future. In classrooms, offices, factories, stores and houses this revolutionary approach to lighting problems will eliminate glare and insure even, shadowless light in every corner of the room.

The Martin Electric Co. has worked closely with professors Moon and Spencer (see story in left-hand column) in an effort to discover the perfect, *inexpensive* material for luminous ceiling installations. After scores of tests and months of research they have perfected a method of processing and shaping a special plastic that answers the most stringent scientific requirements.

This Martin Luminous Ceiling Sheeting, corrugated for rigidity and corrected wave-length pattern, is processed for maximum light transmission coincident with best possible diffusion. Martin Luminous Ceiling Sheeting is not an adaptation—it is a special material, scientifically designed for luminous ceiling work.

The material is ordinarily produced in 36 inch widths, but *any* width up to 36 inches may be ordered in quantity. Martin Sheeting requires no cross-pieces in installation because it comes in rolls of any specified length which can be cut right on the job with shears, penknife, or razor blade.

Send For Free Sample.

M.I.T., BROWN SCIENTISTS DEVELOP NEW LIGHTING APPROACH

A completely new approach to modern room lighting has been developed by Professors Moon and Spencer of M.I.T. and Brown Universities, respectively. Utilizing a translucent, scientifically formed plastic sheeting under fluorescent fixtures, Moon and Spencer have reduced reflected glare and shadow to an absolute minimum while providing steady, even light of maximum brilliance.

Leading lighting engineers have viewed test installations and pronounced the new lighting "as near to perfect as possible." There are no exposed lamps, from any angle in the room, and perfectly diffused light reaches all corners without shadow.

Schools, libraries, offices, stores and institutions are seen as primary beneficiaries of this new lighting.

Send For Free Sample.

BROAD SALES POLICY INCLUDES MANUFACTURERS

Martin plastic sheeting for luminous ceilings is available to fixture manufacturers and architects as well as to the trade through usual channels.

With the increasing popularity of luminous ceilings, interested firms are urged to write to Martin Electric Products, Inc., 346 Somerville Ave., Somerville, Mass., for samples and further information.

CONCLAVE OF SCHOOL HEADS SEE MARTIN PLASTIC SHEETING INSTALLATION

LUMINOUS CEILING JUDGED "CLASSROOM LIGHTING OF FUTURE"

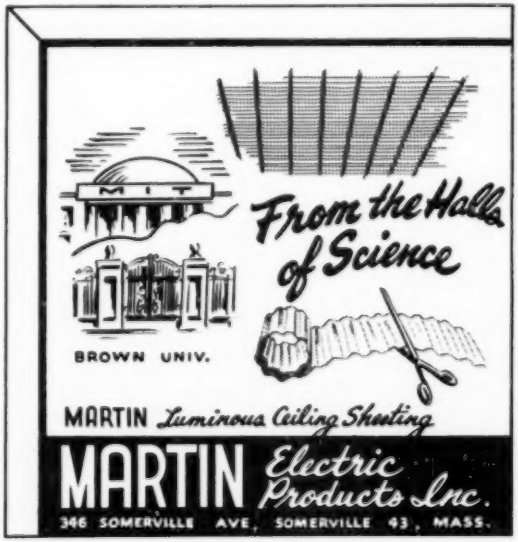
Scores of top educators, attending the New England Development Council's conference on "Better Seeing for Better Schools," viewed a luminous ceiling installation at the Hyde School in Newton, on November 5th (see photo).

Martin plastic sheeting was used throughout the schoolroom and, as no cross-pieces were necessary, installation costs were unusually low. This saving plus the extremely low per foot cost of the new Martin product made it possible to perform a complete, inexpensive transformation in a building completed in 1908.

School superintendents, lighting engineers, and purchasing agents were tremendously impressed with the glareless sight-ease which facilitated study and chalkboard vision.

The Boston Post wrote (of the Hyde School installation): "Children who study in classrooms of the future will have less eye trouble because . . . ceilings will be completely luminous and the light . . . diffused so well [that] all reflected glare is eliminated."

Send For Free Sample.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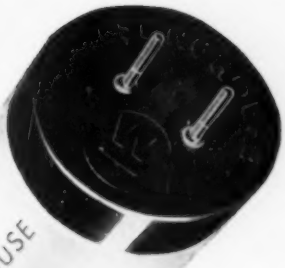
BROWN UNIV.
From the Halls of Science
MARTIN Luminous Ceiling Sheeting
MARTIN Electric Products Inc.
346 SOMERVILLE AVE., SOMERVILLE 43, MASS.

Westinghouse

Fluorescent Lamps



NOW LAST 3 TIMES AS LONG!

...YET COST NO MORE!

SAVE 2/3

SAVE THIS– ONE LAMP NOW LASTS AS LONG AS 3.

LAMP COSTS

TIME SPENT REPLACING BURNED-OUT LAMPS

SAVE THIS– LAMPS NEED BE REPLACED ONLY ⅓ AS OFTEN.

Here's the biggest news in fluorescent lamps that's come along in years . . . NOW Westinghouse fluorescent lamps will last 2½ years in average store installations . . . 3 years in average one-shift office or factory installations.

Light output, too, has been improved—Westinghouse fluorescent lamps now burn brighter and longer than ever before. So, when you buy lamps, buy Westinghouse and save! Lamp Division, Westinghouse Electric Corp., Bloomfield, N. J.

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Westinghouse

wherever there is light

KOPP GLASS . . .

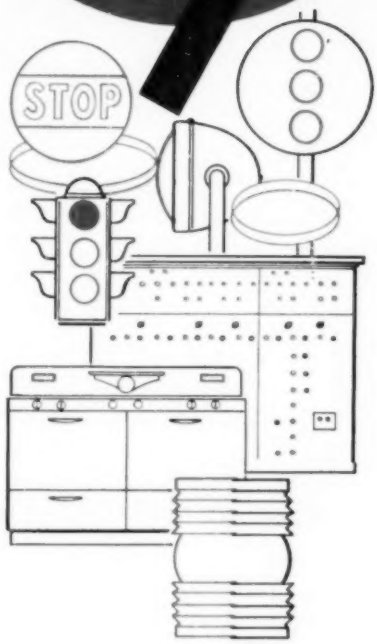
can give it meaning or direction

Kopp Glass products can play an important part in making light do your bidding; you can use Kopp lenses to diffuse, deflect or concentrate beams of light, to transmit colors, for infra-red or ultra-violet applications, for "on" or "off" lights, for all sorts of signals where uniform colors, durability and dimensional accuracy are important. Other Kopp Glass products are liquid-level sight glasses, transparent instrument cases, glass domes, panels for domestic oil burners, beads for glass-to-metal seals, direction signals.

Kopp engineers will design glass parts for your specific applications. Necessary research and development work is conducted in our well-equipped modern laboratories. Moulds are made by our experienced craftsmen, and sample glass parts throughly tested before production starts.

You can be sure of the uniformly high quality of Kopp Glass, for complete control is exercised at every step of production, from the selection of raw materials, to the testing, packing and shipping of finished product.

Use KOPP GLASS to assure complete satisfaction.



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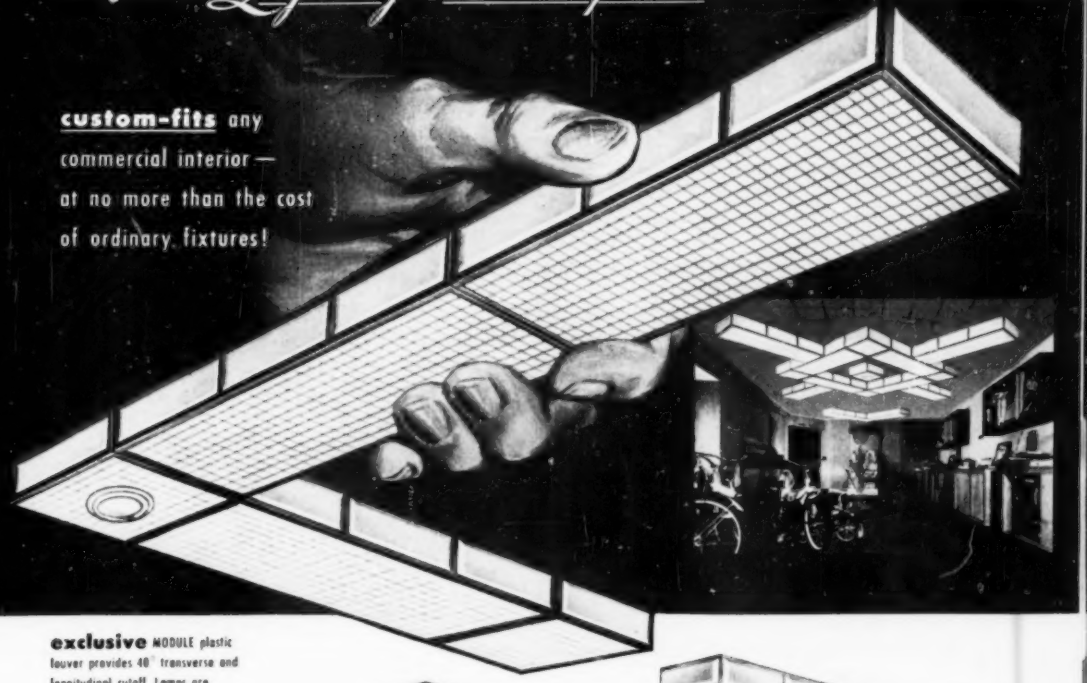
the greatest *Lighting Development* since the fluorescent lamp

custom-fits any commercial interior — at no more than the cost of ordinary fixtures!



exclusive MODULE plastic louver provides 40° transverse and longitudinal cutoff. Lamps are shielded at all normal viewing angles, yet light transmission is maximum.

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side to side **. . . to form more than 50,000 different lighting patterns**

. . . to fit any ceiling shape or size **. . . mixing all**

light sources **in one harmonious system . . . with**

equal brightness throughout **(no dark sides or ends) . . . so you**

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COMPLETE INFORMATION ABOUT LIGHTING THEORY, PRACTICE AND PROCEDURE

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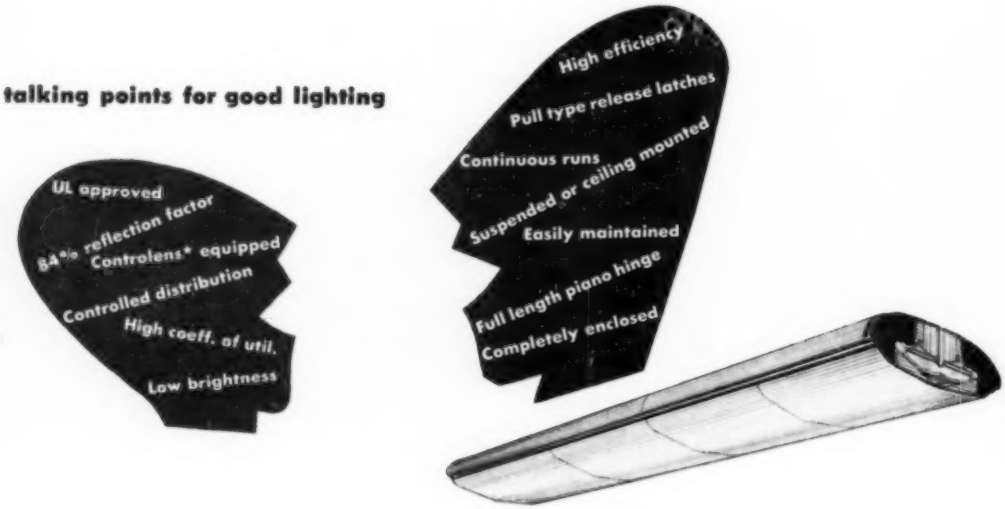
talking points for good lighting



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Continued from page 785

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Continued on page 21A

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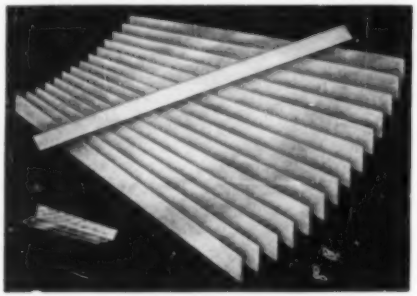

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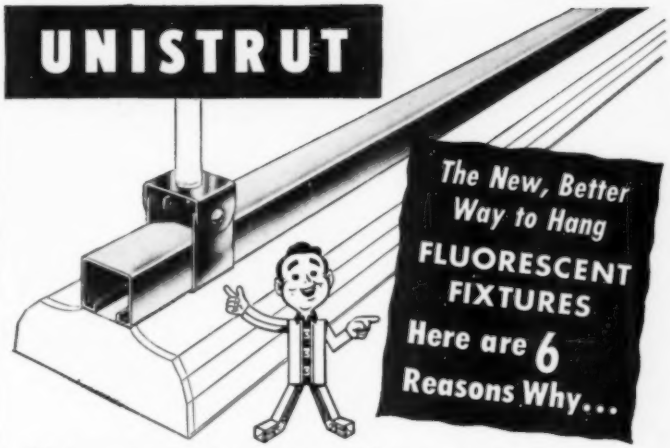

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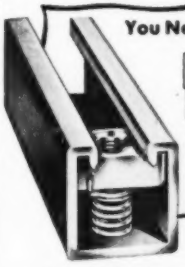

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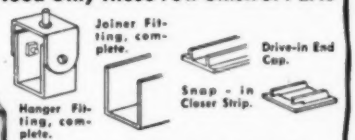

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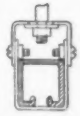

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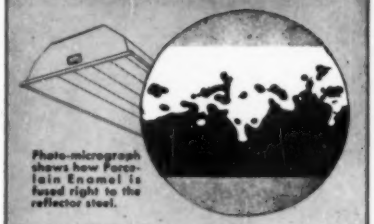

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